TUSTIN (TSN)

SCOS97-NARSTO AUDIT SUMMARY
RADAR PROFILER/RASS/SODAR/SURFACE METEOROLOGY

Site:	Tustin (TSN)
Audit Dates:	July 24, 1997
Instrumentation Audited:	Radar Profiler, RASS, Surface Meteorology
Key Person(s):	Cat Russell
Auditor:	Alexander N. Barnett

The purpose of this summary is to provide a preliminary report of any significant audit findings. The site is operated by NOAA/ETL. Key elements of the audit are identified below.

AUDIT INSTRUMENTATION

No problems with the audit equipment occurred during the audit.

SITE CHARACTERISTICS

The site is located at the southwest corner of the helicopter parking apron. The terrain is flat and open on the east and south sides. Helicopter maintenance hangers are located to the north at approximately 200 to 300 meters. One and two story buildings that make up a light industry industrial park are to the west side at approximately 200 meters.

SYSTEM AUDIT NOTES

1. The both the northeast and southeast RWP antenna zenith angles were measured to be 15.5°. The RWP set up puts these zenith angles at 15°. A calculation of the wind speed and wind direction error attributed to these discrepancies are approximately -3.1% and 0%, respectively. The controller should be reset to compensate for these differences so that the winds are calculated correctly. NOAA/ETL should purchase a digital level to use in the antenna setups. It was found that ½ bubble, for the liquid filled levels, is equivalent to more than 2%.
2. The levels of all of the RASS acoustic sources (a combination of the level of the suspended drivers and the parabolic dishes) exceeded the EPA PAMS recommended criteria of ± 1.0°, in some cases by more than ± 2.0°. There is a concern that if this angle away from the vertical may affect the vertical range of the RASS measurements. NOAA/ETL should purchase a digital level to use in the antenna setups. It was found that ½ bubble, for the liquid filled levels, is equivalent to more than 2%.

3. The NOAA/ETL RASS acoustic sources consist of a parabolic dish and a "floating" acoustic driver that is not connected to the dish. There is a question about how the position of the driver with respect to the focus of the parabolic dish may effect the altitude that the RASS acoustic source signals can reach and the vertical range of the RASS measurements.
4. The temperature and relative humidity sensors are in a non-aspirated radiation shield. The data should therefore not be used in dispersion modeling.
5. There are no signs warning of potential audio or radio frequency radiation. Appropriate signage is recommended.
6. The site is visited approximately once every four weeks. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

POTENTIAL ACTIVE NOISE SOURCES

No RFI was detected from a scan of the frequencies between 914 and 916 mHz, and a listen only check.

POTENTIAL PASSIVE NOISE SOURCES

No passive sources were noted. The north antenna data did not indicate clutter from the hill to the east-northeast of the site.

ANTENNA LEVEL AND ALIGNMENT

1. The RWP pointing angles were set to 55° for the northeast antenna and 139° for the southeast antenna. The audit determined pointing directions were 53° and 139°, respectively. The northeast antenna differed by -2°.
2. The zenith angles of he RWP antennas were 15.5° for both the northeast and southeast facing antennas. These deviations from the RWP controller settings of 15° introduces a error of -3.1% for wind speed.
3. The level of all of the RASS acoustic source drivers and dishes were outside of the EPA PAMS criteria of ±1.0°.

RADAR PROFILER PERFORMANCE AUDIT

A performance audit of the RWP at this site was not performed.

RASS PERFORMANCE AUDIT

A performance audit of the RASS at this site was not performed.

RADAR PROFILER DATA INTERNALCONSISTENCY

1. Overall, the data look reasonable. A review of the data collected during the three days prior to the audit, showed good height coverage in both modes, and consistency in the wind speed and wind direction values between the two modes of operation.

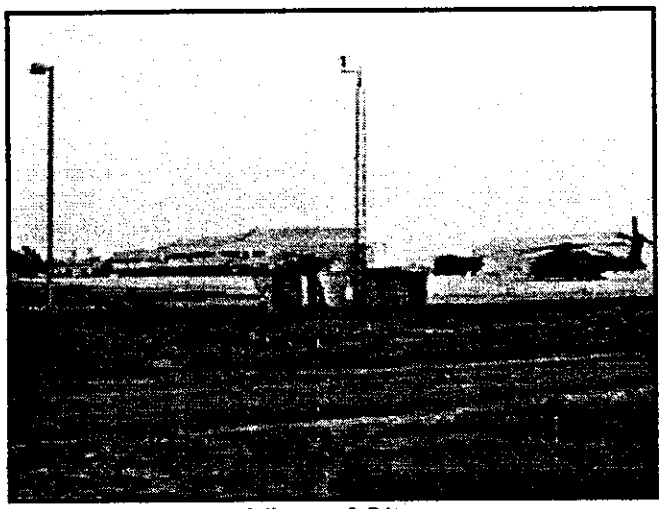
RASS DATA INTERNAL CONSISTENCY

1. Data collected just prior to the audit reached on the average to the 1200 meters level. Many of the hourly averages extending to the maximum height setting of 1628 meters. The internal consistency of the data appears to be good.
2. For the purposes of air quality study objectives, it is recommended that the RASS be operated at a finer resolution (about 60 m). The current mode of operation is 105 m. This will remove some of the spatial averaging and provide a much clearer picture of the atmosphere.

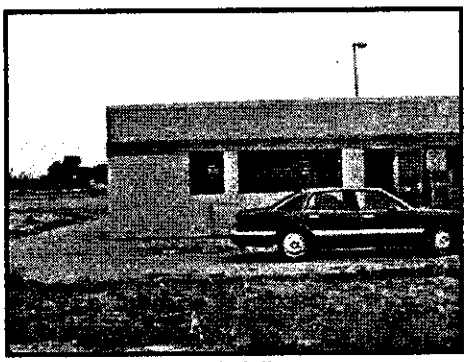
SURFACE METEOROLOGY PERFORMANCE AUDIT

1. The 10 meter wind direction sensor orientation was outside of criteria which produced a total error of 10°. The sensor was aligned following the audit and the alignment verified.
2. All sensors are scanned every 10 seconds with five minute averages recorded. Other than the wind direction alignment error, no problems were noted with the performance audit results. However, not all of the variables could be audited completely. A summary of these audits are provided below:
   - The temperature sensor could not be immersed in water and the probe design was not conducive to placement in a water proof sheath while retaining good thermal conductivity. Only one ambient comparison point was therefore audited.
   - Due to the wiring and the method of sensor installation, the wind direction sensor was not removed from the tower to perform the torque test. Future installations should consider an alternate installation that will allow for appropriate sensor evaluation.
   - Wind data recorded include scalar wind speed and resultant vector wind direction.
   - As indicated above, the 10 meter wind direction sensor orientation was outside of criteria which produced a total error of 10°. The sensor was aligned following the audit and the new alignment verified.

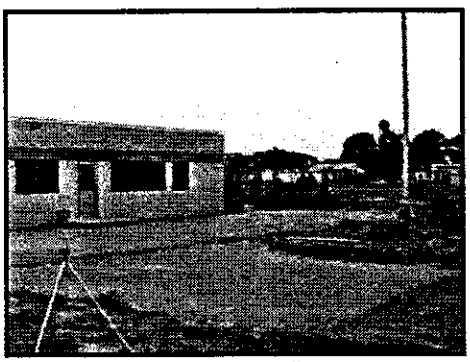
Tustin Site Photographs



View of Site

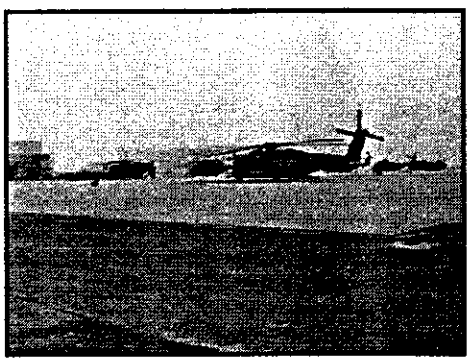


North View



Northeast View

East View



Southeast View

South View

Southwest view

West View

Northwest View

SCOS97-NARSTO

SITING AND SYSTEM AUDIT FORM

MEASUREMENTS GROUP:	NOAA/ETL
SITE NAME AND LOCATION:	Tustin (TUS)
AUDITOR:	Alexander N. Barnett
DATE:	July 24, 1997
KEY PERSON:	Cat Russell

I. Observables

A. Meteorological

Observable	Method	Manufacturer	Model	Serial #	Range
Wind Speed/ Wind Direction	Radar Profiler	NOAA/ETL	915 MHz	915-32-12	Lo 152 - 2296 m at 58 m inc. Hi 152 - 3905 m at 102 m inc.
Virtual Temperature	RASS	NOAA/ETL	915 MHz	915-32-12	157 - 1628 m at 105 m inc. (see below)
	Audio amplifier	Crown	ComTech 400	410461	NA
10 m Wind Speed	Propeller	RM Young	05103	20993	0 - 50 m/s
10 m Wind Direction	Vane	RM Young	05103	22039	0 - 355 degrees
2 m ambient temperature	RTD	Vaisala	HMP-35C	NA	-35 - 50 °C
2 m relative humidity	Solid State	Vaisala	HMP-35C	NA	0 - 100%
Data Logging	Digital	Campbell	21X	12111	NA

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

Are there any required variables which are not measured? No

Are there any methods and/or equipment that are not in the SOP? Yes

Do any operating ranges differ from those specified in the SOP? See Below

Are there any significant differences between instrumentation on site and the SOP? No

Comments: Station is also monitoring total solar and net radiation and barometric pressure. As indicated above the RASS resolution should be increased to about 60 m.

B. Auxiliary Equipment

Type	Manufacturer	Model	Serial #	Last Calibration Date
Communications computer	SMT	NA	NA	NA
RWP computer	Industrial Computer Source	NA	NA	NA
RASS amplifier	Crown	Com Tech 400	410461	NA
Power conditioner	Best	ME1-4kva	NA	NA
Optical WORM drive	NA	NA	NA	NA

Comments:

B. Station Check Equipment

Type	Manufacturer	Model	Serial #	Comments
NA[1]	NA	NA	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA

Comments:

1. Station check equipment is carried with the NOAA engineers and not left on site.

II. Sensor/Probe height and Exposure

A. Radar Profiler/RASS/Sodar

Variable	Value	Meet SOP (Yes/No)
1. Orientation (three axis radar antenna)	Radar – 2°, 0° 10 m Vane – 10°	Yes No
2. Level (level and inclination of the horiz ant)	Radar – 0.5° RASS – 3.2°	Yes No
3. Distance to closest obstruction	Not significant	Yes
4. Distance to closest active noise source	No significant active RF sources	Yes

Comments:

1. The 10 meter wind vane orientation was outside orientation criteria by 10°.
2. The RWP oblique antenna level, for both antennas was found to be 15.5°. The set up in the RWP controller is 15.0°.

2. The north RASS acoustic source transducer was out of level by 3.2°. The west RASS acoustic source transducer and driver were out of level by 2.3° and 2.3°, respectively. The south RASS acoustic source transducer was out of level by 1.6°. The east RASS acoustic source transducer and driver were out of level by 2.2° and 1.4°, respectively.

4. A listen only test of the radar revealed no significant RF sources nearby.

B. Surface Meteorology

Variable	Value	Meet SOP (Yes/No)
1. Height of wind sensors above ground	10 m	Yes
2. Distance to nearest obstacle	None	Yes
3. Is separation at least 10x obst. height?	NA	NA
4. Are instruments on a rooftop?	No	NA
5. Is exposure 1.5x height above roof	NA	NA
6. Arc of unrestricted flow	360°	Yes
7. Height of temp sensor above ground	1.5 m	Yes
8. Distance of temp sensor from obst.	Okay	Yes
9. Height of DP/RH sensor above ground	2 m	Yes
10. Distance of DP/RH sensor from obst.	Okay	Yes
11. Are the distances 4x the obst. height?	Yes	Yes
12. Is the sensor shielded or aspirated?	Shielded	Yes
13. Are the T/DP/RH abv representative terrain?	Yes	Yes
14. Are there significant differences between on-site equipment and the monitoring plan?	No	Yes

Comments:

1. Wind data recorded include scalar wind speed and resultant vector wind direction. All surface sensors are scanned every 10 seconds with five minute averages recorded.

12. The temperature and relative humidity sensors are in a non-aspirated radiation shield. The data should therefore not be used in dispersion modeling.

III. Operation

A. Radar Profiler, RASS and Surface Meteorology

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is all instrumentation operational?	Yes	Yes
2. Are all cables secure?	Yes	Yes
3. Are all cables connected according to SOPs or instrument manuals?	Yes	Yes
4. Are connections clean and rust free?	Yes (see below)	Yes
5. Are serial numbers available?	Yes	Yes
6. Do data system times agree with audit times. If not, what is the deviation?	Yes ~ 30 sec.	Yes
7. Is the printer functional?	NA	NA
8. Overall, is the site maintenance sufficient to meet the DQOs?	See below	Yes

Comments:

5. Did not want to move equipment to get serial numbers.

8. The site is visited approximately every four weeks for routine maintenance. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

B. Radar Profiler/RASS/Sodar Settings

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Software version	POP 4.1	Yes
2. High mode pulse length	700 ns	Yes
3. Low mode pulse length	400 ns	Yes
4. RASS pulse length	700 ns	Yes
5. RASS acoustic temperature Range?	10 - 40°C	Yes
6. RASS acoustic source range?	10 - 40°C	Yes
7. Time zone	GMT	Yes
8. Wind data consensus	53 min (see below)	Yes
9. RASS consensus	7 min (see below)	Yes

Comments:

8, 9. The configuration was changed to gave a 53 minute wind data consensus and a 7 minute RASS consensus. This was done in response to findings at other

NOAA sites where it was found that the polling of the surface data during the first five minutes of the hour only gave about a 3.5 minute RASS consensus.

	Wind Low Mode	Wind High Mode	RASS
First Gate	152 m	152 m	157 m
Last Gate	2296 m	3905 m	1628 m
Spacing	58 m	102 m	105 m
Full Scale Velocity	10.2 m/s	10.2 m/s	409.6 m/s

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

B. Auxiliary Equipment

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is the A/C unit sufficient to maintain temperatures in the range specified in the SOPs?	Yes	Yes
2. Is the site temperature recorded?	No	See below
3. Is the site temperature maintained at 20-30°C?	Yes	See below
4. Is the site kept clean enough to allow operation of all instruments as specified in the SOP?	Yes	Yes
5. Does the modem work?	Yes	Yes
6. Does the telephone work?	Yes	Yes
7. Is the site secure?	Yes (see below)	Yes
8. Overall, is the auxiliary equipment maintenance sufficient to meet the DQOs?	Yes	Yes

Comments: 2. There is no measurement of the shelter temperature. It was indicated that the temperature is not critical for the system operation.

7. Security is good. There are no signs warning of potential audio or radio frequency radiation. Appropriate signage is recommended.

C. Station Check Procedures and Documentation

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Are the station logs present?	Yes	Yes
2. Are the station logs up to date?	Yes	Yes
3. Do station logs contain details as required by the SOPs?	Yes	Yes
4. Are routine checklists used?	Yes	Yes
5. Do the routine checklists contain details as required by the SOPs?	Yes	Yes
6. Are the calibration forms present?	No	See below
7. Do the calibration forms contain details as required by the SOPs?	NA	NA
8. Are the SOPs present?	Yes	Yes
9. Are the instrument manuals present?	No	See below
10. Do the SOPs include quality control tests?	Yes	Yes
11. If quality control tests are included then how are the results of the tests documented?	In site checklist	Yes
12. Has the site technician undergone training as specified in the SOPs?	See Below	Yes
13. Is the site visited twice weekly?	No	See below
14. Does the site technician understand the SOPs?	Yes	Yes (see below)

Comments: 6. Calibration records are maintained at NOAA/ETL

9. Manuals are maintained at NOAA/ETL. If repairs are needed then the engineer brings the manuals to the site.

12. There are no site technicians. During most times there is an engineer in the field that travels from site to site for the checks and needed maintenance.

13, 14. The site is visited approximately every four weeks for routine maintenance. In between the visits the data are polled and reviewed on a regular basis. Data are retrieved hourly and reviewed daily. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

D. Chain of Custody

1. Review paper work for chain of custody from field to data processing.	Comments: The site is inspected every four weeks with all data archived at that time. Paperwork older than about two months is forwarded to NOAA/ETL.
2. How are data stored?	Data are stored locally on the computer hard drive with consensus files and surface data transferred on an hourly basis to the communications computer. The files on the communications computer are downloaded to NOAA/ETL on an hourly basis and then erased.
3. How often are the data backed up?	Files are copied to an optical drive on an hourly basis. These data are recovered on a monthly basis when the engineer visits the site.

Comments: 1. It is recommended a carbonless or similar form be used for the site checklist. In that manner a copy could be left at the site while the original can be sent back to NOAA/ETL.

V. Preventive Maintenance

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is preventive maintenance discussed in the SOPs?	Yes	Yes
2. Is preventive maintenance being performed?	Yes	Yes
3. Are field operators given special training in preventive maintenance?	Yes	Yes
4. Are tools and spare parts adequate at the site to meet the requirements of the SOPs?	See below	Yes
5. Are maintenance logs maintained and reviewed?	Yes	Yes

Comments: 4. Tools and spares are carried with the field engineers. Some spares such as RASS transducers are stored at various sites throughout the NOAA/ETL network.

VI. Overall Comments

Question	Response (Yes/No)	Meet Work Plan (Yes/No)
1. Overall, is the station maintenance sufficient to meet the DQOs?	Yes	Yes
2. Does the siting meet the program objectives?	Yes	Yes
3. Overall, is the site technician trained as specified in the SOPs?	Yes	Yes
4. Does the QC program appear to be working?	Yes	Yes
5. Overall, does the meteorological data look reasonable?	Yes	See below
6. Overall, does the data appear to meet the program objectives?	Yes	Yes

Comments:

5. It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 106 m. The finer resolution will remove some of the spatial averaging and provide a much clearer picture of the atmosphere.

SCOS97-NARSTO AUDIT RECORD
VISTA, ORIENTATION AND LEVEL

Site Name:	Tustin	Instrument:	NOAA/ETL
Date:	7/24/97	Receiver s/n:	915-32-12
Time:		Interface s/n:	915-32-12
Measurements group:	NOAA/ETL	Firmware version:	POP-4
Key contact:	Cat Russell	System rotation angle:	NE: 55°, SE: 139°
Audited by:	Alex Barnett	Measured orientation:	NE: 53°, SE: 139°
Site longitude:	117° 50.31' W	Orientation difference:	NE: 2°, SE: 0°
Site latitude:	33° 42.51'N	Array level:	NE: 15.5° SE: 15.5°
Site elevation:	463 meters	Beam zenith angle:	NE: 15.0° SE: 15.0°
Magnetic declination:	14°E	Zenith difference:	NE: 0.5°, SE: 0.5°

Mag. Az. Angle (deg)	True Az. Angle (deg)	Terrain El. Angle (deg)	Features and Distances
NA	0	<2	West edge of aircraft parking apron. Hangers in the distance.
NA	30	<2	Aircraft parking apron. Aircraft hangers in the distance.
NA	60	<2	Aircraft parking apron.
NA	90	<2	South edge of aircraft parking apron.
NA	120	<2	Open area south of aircraft parking apron. ¼ mile to busy street.
NA	150	<2	Strawberry field. 4' chain link fence 30m away. ¼ mile to busy street.
NA	180	<2	Strawberry field. 4' chain link fence 30m away. ¼ mile to busy street.
NA	210	5	Strawberry field. 150m to base boundary that runs along Red Hill Road. 20' tall trees line Red Hill Road. Single story industrial park on West side of Red Hill Road.
NA	240	5	120m to base boundary that runs along Red Hill Road. 20' tall trees line Red Hill Road. Single story industrial park on West side of Red Hill Road.
NA	270	5	100m to base boundary that runs along Red Hill Road. 20' tall trees line Red Hill Road. Single story industrial park on West side of Red Hill Road.
NA	300	10	Building 15' high 10m from site.
NA	330	10	Building 15' high 10m from site.

Comments:

SCOS97-NARSTO AUDIT RECORD
HORIZONTAL WIND SPEED

Date: July 24, 1997
Start: 11:17 PDT
Finish: 11:45 PDT
Auditor: Alex Barnett

Site name: Tustin
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Cat Russell

Sensor Mfg: R.M.Young
Sensor s/n: 20993
K factor: 1.4
Range: 0 - 50 m/s
Logger: Campbell CR-10X
Logger s/n:
Prop s/n: 467344

Model: 05103
Sensor Ht.: 10 meters
Starting torque: 0.2 gm-cm
Starting Threshold: 0.38 m/s

Last calibration date: XXXX

	Cal. Factors	
	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

WS Calibration Point	M/S Input	M/S Chart	M/S Diff. Chart	M/S DAS	M/S Diff. DAS	% Diff. DAS
1	0.0	#N/A	#N/A	0.0	0.0	#N/A
2	2.5	#N/A	#N/A	2.5	0.0	#N/A
3	4.9	#N/A	#N/A	4.9	0.0	#N/A
4	14.7	#N/A	#N/A	14.7	0.0	0.0
5	24.5	#N/A	#N/A	24.5	0.0	0.0
6	34.3	#N/A	#N/A	34.3	0.0	0.0

Pass/Fail Criteria: +/-.25 m/s; ws <= 5 m/s
+/- 5%; ws > 5 m/s

Comments: Okay.

SCOS97-NARSTO AUDIT RECORD
HORIZONTAL WIND DIRECTION

Date: July 24, 1997
Start: 11:17 PDT
Finish: 11:45 PDT
Auditor: Alex Barnett

Site name: Tustin
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Cat Russell

Sensor Mfg: R.M.Young
Serial No.: 20993
K Factor: 29.8
Range: 0 - 355 deg
Logger: Campbell CR-10X
Logger s/n: XXXXX

Model: 05103
Sensor Ht.: 10 meters
Starting torque: 5.0 gm-cm
Starting threshold: 0.41 M/S

Last calibration date: XXXX

Crossarm: 321 deg true

Cal. Factors

	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

WD Audit Point	Degrees Reference	Corrected Degrees Reference	Degrees Chart	Diff. Chart Deg.	Degrees DAS	Linearity	Total Diff DAS Deg.
Orientation	321.0				3.0		-11.0
1	53	53.0	#N/A	#N/A	43.0	-0.5	-10.0
2	137	137.0	#N/A	#N/A	130.0	2.5	-7.0
3	230	230.0	#N/A	#N/A	220.0	-0.5	-10.0
4	321	321.0	#N/A	#N/A	310.0	-1.5	-11.0
5							
6							
7							
8							
9							
10							
11							

Avg difference:		-9.5
Maximum difference:	2.5	-11.0

Criteria: Orientation: +/- 2 degrees
Linearity: +/- 3 degrees
Maximum Difference: +/- 5 degrees

Comments: Did not meet audit criteria. Sensor orientation adjusted after audit

SCOS97-NARSTO AUDIT RECORD
AMBIENT TEMPERATURE

Date: July 24, 1997
Start: 10:38 PDT
Finish: 10:45 PDT
Auditor: Alex Barnett

Site name: Tustin
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Cat Russell

Sensor Mfg: Vaisala
Serial No.: 1440021
Range: -50 to 5(Deg C

Model: HMP-35C
Sensor Ht.: 1.5 meters

Logger: Campbell CR-10X
Logger s/n: XXXXX

Last calibration date: XXXX

	Cal. Factors	
	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

Temperature Audit Point	Deg C Input	Deg C Chart	Deg C Diff. Chart	Deg C DAS	Deg C Diff. DAS
1	21.4	#N/A	#N/A	20.9	-0.5

Criteria: +/- 0.5 degree Celsius

Comments: Okay.

SCOS97-NARSTO AUDIT RECORD
RELATIVE HUMIDITY (EQUIVALENT DEW POINT TEMPERATURE)

Date: July 24, 1997
Start: 10:38 PDT
Finish: 10:45 PDT
Auditor: Alex Barnett

Site name: Tustin
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Cat Russell

Sensor Mfg: Vaisala
Serial No.: 1440021
Range: 0 - 100 Percent

Model: HMP-35C
Sensor Ht.: 3 meters

Logger: Campbell CR-10X
Logger s/n: XXXXX

Last calibration date: XXXX

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

RH/DP Audit Point	%RH Input	Deg C Input	% RH Chart	Deg C Chart	Deg C Diff. Chart	%RH DAS	Deg C DAS	Deg C Diff. DAS
1	72.1	16.4	#N/A	#N/A	#N/A	58.0	17.1	0.7

Criteria: +/- 1.5 degree Celsius

Comments: Okay.

UNIVERSITY OF SOUTHERN CALIFORNIA (USC)

SCOS97-NARSTO AUDIT SUMMARY
RADAR PROFILER/RASS/SODAR/SURFACE METEOROLOGY

Site:	Central Los Angeles (USC)
Audit Dates:	July 2, 1997
Instrumentation Audited:	Radar Profiler, RASS, Surface Meteorology
Key Person(s):	Clark King
Auditor:	Robert A. Baxter

The purpose of this summary is to provide a preliminary report of any significant audit findings. The site is operated by NOAA/ETL. Key elements of the audit are identified below.

AUDIT INSTRUMENTATION

No problems were encountered with the audit instrumentation.

SITE CHARACTERISTICS

The site is on top of building with the roof height about 15 meters above the ground. The surface meteorological measurements are taken from a 3 meter tripod on top of the building. The building will affect the accuracy of all measurements. The wind information should only be used for QC of the profiler data. The temperature and humidity data should not be used to calculate the surface virtual temperature for integration into the RASS data. The site is good for representing the upper air winds above Los Angeles.

SYSTEM AUDIT NOTES

1. The temperature and relative humidity sensors are in a non-aspirated radiation shield. The data should therefore not be used in dispersion modeling. In addition, the sensors are mounted on a black topped roof which will tend to bias temperatures high during day and low at night.
2. The surface wind direction sensor orientation was high by 7°. The sensor was aligned following the audit and the alignment verified.
3. There are no signs warning of potential audio or radio frequency radiation. Appropriate signage is recommended.

4. Three of the RASS dishes were out of level by 1.0 to 1.6 degrees. All transducers were within criteria. Consideration should be given to leveling the dishes.
5. The site is visited approximately once every four weeks. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.
6. The primary radar profiler/RASS hard disk drive failed during a backup procedure during the audit. The system will be down until it is repaired. The repair is anticipated on 7/8/97.

POTENTIAL ACTIVE NOISE SOURCES

An RF scan of the frequencies from 914 to 916 MHz showed some voice transmissions in the operating range of the radar. This transmissions were images of cell phone frequencies received through an IF in the scanner and were therefore not actually in the radar operating range. Operation in the "listen only" mode showed no interference problems.

POTENTIAL PASSIVE NOISE SOURCES

There are some trees in the beam directions that could produce clutter. Review of the data in days prior to the audit did show missing and erroneous data in the lowest several gates probably due to the clutter.

ANTENNA LEVEL AND ALIGNMENT

The radar profiler antenna array orientation differed from the audit orientation by 19°. The audit orientation was verified by the site engineer and changes made to the system setup. Data prior to the audit will need appropriate corrections to the wind direction data.

RADAR PROFILER PERFORMANCE AUDIT

Not applicable (no performance audit performed).

RASS PERFORMANCE AUDIT

Not applicable (no performance audit performed).

RADAR PROFILER DATA INTERNAL CONSISTENCY

Data prior to the audit were reviewed from the ETL web site. Overall, the data look reasonable. Comparisons to surface winds collected during the same reviewed periods showed reasonable general agreement in the direction. However, there were obvious erroneous data in the radar profiler in some of the reported winds in excess of 15 m/s.

RASS DATA INTERNAL CONSISTENCY

1. During the period of the audit the vertical extent of the RASS data looked limited. Whether this was due to the current meteorological conditions or the partially covered RASS source dish on the north side is unknown. A review of RASS data collected over the last 4 to 5 days showed a capability to about 800 to 900 meters, on the average.
2. The overall data look reasonable. However, it is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 106 m. This will remove some of the spatial averaging and provide a much clearer picture of the atmosphere. When changing the resolution, the height range should be maintained by increasing the number of range gates collected.

SURFACE METEOROLOGY PERFORMANCE AUDIT

All sensors are scanned every 10 seconds with five minute averages recorded. Other than the wind direction alignment error noted above, no problems were noted with the performance audit results. A summary of these audits are provided below:

1. Due to the wiring and the method of sensor installation, the wind direction sensor was not removed from the system to perform the torque tests. A qualitative check of the bearings was performed and they were found to be acceptable.
2. Wind data recorded include scalar wind speed and resultant vector wind direction.
3. As indicated above, the 10 meter wind direction sensor orientation was outside of criteria which produced a total error at the furthest point of 9.5°. The sensor was aligned following the audit and the new alignment verified to be within 2° true (182° box alignment). It is recommended a solar alignment method be used at sites that may have magnetic interference. The current method using the magnetic method with general declination corrections has shown some problems in identifying the true alignment directions.

SCOS97-NARSTO

SITING AND SYSTEM AUDIT FORM

MEASUREMENTS GROUP:	NOAA/ETL
SITE NAME AND LOCATION:	Central Los Angeles (USC)
AUDITOR:	Robert A. Baxter
DATE:	July 2, 1997
KEY PERSON:	Clark King

I. Observables

A. Meteorological

Observable	Method	Manufacturer	Model	Serial #	Range
Wind Speed/ Wind Direction	Radar Profiler	Radian Corp.	LAP-3000 Interface Receiver/ Modulator Profiler Monitor Antennas	RX – 7945 TX – 7963	Lo 151 - 2186 m at 55 m inc. Hi 172 - 3732 m at 97 m inc.
Virtual Temperature	RASS	Radian Corp.	LAP-3000		188 - 1658 m at 105 m inc. (see below)
	Audio amplifier	Peavey	CS-800	NA	NA
10 m Wind Speed	Propeller	RM Young	Wind Monitor	16384	0 - 50 m/s
10 m Wind Direction	Vane	RM Young	Wind Monitor	16384	0 - 355 degrees
2 m ambient temperature	RTD	CSI	207	NA	-35 - 50 °C
2 m relative humidity	Solid State	CSI	207	NA	0 - 100%
Data Logging	Digital	CSI	CR10	X4762	NA

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

Are there any required variables which are not measured? No

Are there any methods and/or equipment that are not in the SOP? Yes

Do any operating ranges differ from those specified in the SOP? See Below

Are there any significant differences between instrumentation on site and the SOP? No

Comments: Station has solar and net radiation in addition to pressure being monitored. As indicated above the RASS resolution should be increased to about 60 m.

B. Auxiliary Equipment

Type	Manufacturer	Model	Serial #	Last Calibration Date
Communications computer	NOAA	NA	NA	NA
JAZ drive	NA	NA	NA	NA

Comments:

B. Station Check Equipment

Type	Manufacturer	Model	Serial #	Comments
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA

Comments: Station check equipment is carried with the NOAA engineers and not left on site.

II. Sensor/Probe height and Exposure

A. Radar Profiler/RASS/Sodar

Variable	Value	Meet SOP (Yes/No)
1. Orientation (phased array radar antenna)	Radar – -19° 10 m Vane – 7°	No
2. Level	Radar -- <0.4° RASS (dish) – <1.6° RASS (tran) – <0.9°	Yes No
3. Distance to closest obstruction	Not significant	Yes
4. Distance to closest active noise source	No significant active RF sources	Yes

Comments: 1. The orientation of the radar profiler antenna was off by 19°. There was a discrepancy between the readings of the auditor and site operator on the actual directions. This was resolved through a series of comparisons and identifying a potential nonlinearity and/or magnetic interference in the electronic compass used by the site operator. The audit values referenced the readings to solar observations. The 10 meter wind vane was also outside orientation criteria for the same reason.

2. Three of the RASS dishes were out of level by 1.0 to 1.6 degrees. All transducers were within criteria.

4. The listen only test showed no active sources in the operating range of the radar.

B. Surface Meteorology

Variable	Value	Meet SOP (Yes/No)
1. Height of wind sensors above ground	18 m (15 m building ht plus the 3 meter mast)	No
2. Distance to nearest obstacle	The building below	see below
3. Is separation at least 10x obst. height?	NA	NA
4. Are instruments on a rooftop?	Yes	No
5. Is exposure 1.5x height above roof	No	No
6. Arc of unrestricted flow	360°	Yes
7. Height of temp sensor above roof	2 m	No
8. Distance of temp sensor from obst.	The building below	No
9. Height of DP/RH sensor above roof	2 m	No
10. Distance of DP/RH sensor from obst.	The building below	No
11. Are the distances 4x the obst. height?	NA	NA
12. Is the sensor shielded or aspirated?	Shielded	Yes
13. Are the T/DP/RH abv representative terrain?	No	No
14. Are there significant differences between on-site equipment and the monitoring plan?	No	Yes

Comments: 1 - 11, 13, 14. The meteorological system is on a 3 meter mast on top of the building. The building will influence the measurements. The sensors are mounted on a black topped roof which will tend to bias temperatures high during day and low at night and will influence the relative humidity measurements. The data should therefore not be used to calculate the base level virtual temperatures for comparisons to the RASS data.

Wind data recorded include scalar wind speed and resultant vector wind direction. All surface sensors are scanned every 10 seconds with five minute averages recorded.

12. The temperature and relative humidity sensors are in a non-aspirated radiation shield. That combined with the siting underscore the data should not be used in dispersion modeling.

III. Operation

A. Radar Profiler, RASS and Surface Meteorology

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is all instrumentation operational?	No (see below)	No
2. Are all cables secure?	Yes	Yes
3. Are all cables connected according to SOPs or instrument manuals?	Yes	Yes
4. Are connections clean and rust free?	Yes	Yes
5. Are serial numbers available?	Yes	Yes
6. Do data system times agree with audit times. If not, what is the deviation?	Yes	Yes
7. Is the printer functional?	No	Not used
8. Overall, is the site maintenance sufficient to meet the DQOs?	See below	Yes

Comments: 1. During the audit the hard disk on the radar profiler failed not allowing a reboot of the system. The drive is expected to be repaired within one week.

8. The site is visited approximately every four weeks for routine maintenance. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

B. Radar Profiler/RASS/Sodar Settings

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Software version	POP 4	Yes
2. High mode pulse length	700 ns	Yes
3. Low mode pulse length	400 ns	Yes
4. RASS pulse length	700 ns	Yes
5. Time zone	GMT	Yes
6. Wind data consensus	55 min (see below)	Yes
7. RASS consensus	5 min (see below)	Yes

Comments: 6, 7. The configuration indicated gave a 55 minute wind data consensus but because of the polling of the surface data during the first five minutes of the hour only gave about a 3.5 minute RASS consensus. Following the audit the RASS, the consensus was increased to 7 minutes to effectively provide a 5.5 minute consensus period (allowing the 1.5 minutes for the surface data polling). This also reduced the wind data consensus from 55 to 53 minutes.

	Wind Low Mode	Wind High Mode	RASS
First Gate	151 m	172 m	188 m
Last Gate	2186 m	3732 m	1658 m
Spacing	55 m	97 m	105 m
Full Scale Velocity	10.2	10.2	NA

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

B. Auxiliary Equipment

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is the A/C unit sufficient to maintain temperatures in the range specified in the SOPs?	No (see below)	Yes
2. Is the site temperature recorded?	No	See below
3. Is the site temperature maintained at 20-30°C?	Yes	See below
4. Is the site kept clean enough to allow operation of all instruments as specified in the SOP?	Yes	Yes
5. Does the modem work?	Yes	Yes
6. Does the telephone work?	Yes	Yes
7. Is the site secure?	Yes (see below)	Yes
8. Overall, is the auxiliary equipment maintenance sufficient to meet the DQOs?	Yes	Yes

Comments: 1. There was no air conditioning, however, the temperatures are not expected to be a problem at the site.

2, 3. There is no measurement of the shelter temperature. It was indicated that the temperature is not critical for the system operation.

7. Security is good. There are no signs warning of potential audio or radio frequency radiation. Appropriate signage is recommended.

C. Station Check Procedures and Documentation

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Are the station logs present?	Yes	Yes
2. Are the station logs up to date?	Yes	Yes
3. Do station logs contain details as required by the SOPs?	Yes	Yes
4. Are routine checklists used?	Yes	Yes
5. Do the routine checklists contain details as required by the SOPs?	Yes	Yes
6. Are the calibration forms present?	No	See below
7. Do the calibration forms contain details as required by the SOPs?	NA	NA
8. Are the SOPs present?	Yes	Yes
9. Are the instrument manuals present?	No	See below
10. Do the SOPs include quality control tests?	Yes	Yes
11. If quality control tests are included then how are the results of the tests documented?	In site checklist	Yes
12. Has the site technician undergone training as specified in the SOPs?	See Below	Yes
13. Is the site visited twice weekly?	No	See below
14. Does the site technician understand the SOPs?	Yes	Yes (see below)

Comments: 6. Calibration records are maintained at NOAA/ETL

9. Manuals are maintained at NOAA/ETL. If repairs are needed then the engineer brings the manuals to the site.

12. There are no site technicians. During most times there is an engineer in the field that travels from site to site for the checks and needed maintenance.

13, 14. The site is visited approximately every four weeks for routine maintenance. In between the visits the data are polled and reviewed on a regular basis. Data are retrieved hourly and reviewed daily. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

D. Chain of Custody

1. Review paper work for chain of custody from field to data processing.	Comments: The site is inspected every four weeks with all data archived at that time. Paperwork older than about two months is forwarded to NOAA/ETL.
2. How are data stored?	Data are stored locally on the computer hard drive with consensus files and surface data transferred on an hourly basis to the communications computer. The files on the communications computer are downloaded to NOAA/ETL on an hourly basis and then erased.
3. How often are the data backed up?	Files are copied to a Jaz drive on an hourly basis. These data are recovered on a monthly basis when the engineer visits the site.

Comments: 1. It is recommended a carbonless or similar form be used for the site checklist. In that manner a copy could be left at the site while the original can be sent back to NOAA/ETL.

V. Preventive Maintenance

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is preventive maintenance discussed in the SOPs?	Yes	Yes
2. Is preventive maintenance being performed?	Yes	Yes
3. Are field operators given special training in preventive maintenance?	Yes	Yes
4. Are tools and spare parts adequate at the site to meet the requirements of the SOPs?	See below	Yes
5. Are maintenance logs maintained and reviewed?	Yes	Yes

Comments: 4. Tools and spares are carried with the field engineers. Some spares such as RASS transducers are stored at various sites throughout the NOAA/ETL network.

VI. Overall Comments

Question	Response (Yes/No)	Meet Work Plan (Yes/No)
1. Overall, is the station maintenance sufficient to meet the DQOs?	Yes	Yes
2. Does the siting meet the program objectives?	Surface – No Aloft – Yes	No Yes
3. Overall, is the site technician trained as specified in the SOPs?	Yes	Yes
4. Does the QC program appear to be working?	Yes	Yes
5. Overall, does the meteorological data look reasonable?	Yes	See below
6. Overall, does the data appear to meet the program objectives?	Surface – No Aloft – Yes	No Yes

Comments: 2. The siting of the surface sensors do not meet criteria. The data should only be used for qualitative QC of the radar wind profiler and RASS data and not for any numerical calculations.

5. Data prior to the audit were reviewed from the ETL web site. Overall, the data look reasonable. Comparisons to surface winds collected during the same reviewed periods showed reasonable general agreement in the direction. However, there were obvious erroneous data from the radar profiler in some of the reported winds in excess of 15 m/s. These values were probably caused by clutter and should be flagged during the data validation and removed from the data base. It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 105 m. The finer resolution will remove some of the spatial averaging and provide a much clearer picture of the atmosphere. When changing the resolution, the height range should be maintained by increasing the number of range gates collected.

6. The surface data do not meet the objectives.

SCOS97-NARSTO AUDIT RECORD
VISTA, ORIENTATION AND LEVEL

Site Name:	Central Los Angeles (USC)	Instrument:	Radian LAP 3000 RWP
Date:	July 2, 1997	Receiver s/n:	7945
Time:	0930 PDT	Transmitter s/n:	7963
Measurements group:	NOAA/ETL	Firmware version:	POP 4
Key contact:	Clark King	System antenna angle:	136°
Audited by:	Bob Baxter	Measured orientation:	117°
Site longitude:	118° 17.12' W	Orientation difference:	-19°
Site latitude:	34° 01.19' N	Antenna level diff.:	< 0.4°
Site elevation:	71 meters (on bldg.)	Beam zenith angle:	23.6°
Magnetic declination:	15° (appx)	Beam directions:	136°, 226° ind.

Mag. Az. Angle (deg)	True Az. Angle (deg)	Terrain El. Angle (deg)	Features and Distances
NA	0	8	Trees, building and tower structure at ~ 200 - 400 m
NA	30	12	Building with structure on top at ~ 400 m. Trees in near field.
NA	60	12	Exhaust vent at ~15 m. Trees in near field at 4°.
NA	90	9	Trees at ~ 40 m. Building at ~ 500 m.
NA	120	8	Trees at ~ 50 m.
NA	150	6	Trees at ~ 50 m.
NA	180	4	Building at ~ 100 m.
NA	210	14	Building at ~ 100 m.
NA	240	9	Clock tower at ~ 300 m.
NA	270	3	Buildings at ~ 100 - 500 m.
NA	300	20	Meteorological sensor mast and antennas at ~ 10 m.
NA	330	8	Building at ~ 200 m.

Comments: The array orientation differed from the audit by -19°. The radar profiler system settings were corrected at 1243 PDT. The antenna system is a phased array. The RASS system is operating with approximately a 3.5 minute consensus period. A 5 minute period was achieved following the audit by programming the consensus period to 7 minutes allowing the additional time for access and transfer of the surface data. The RASS has 12 range gates with approximately 100 meter gate spacing. A range up to 1500 meters with a gate spacing of 60 meters is recommended. Three of the RASS dishes were out of level by 1.0 to 1.6 degrees.

SCOS97-NARSTO AUDIT RECORD
HORIZONTAL WIND SPEED

Date: July 2, 1997
Start: 1105 PDT
Finish: 1130 PDT
Auditor: Bob Baxter

Site name: Cent LA (USC)
Project: SCOS97-NARSTO
Operator: NOAA/ETL
Site Operator: Clark King

Sensor Mfg: R.M. Young
Sensor s/n: 16348
K factor: 2.4
Range: 0 - 50 m/s
Logger: CR10
Logger s/n: X4762
Prop s/n: 47225

Model: Wind Monitor
Sensor Ht.: 10 m
Starting torque: 0.2 gm-cm
Starting Threshold: 0.29 m/s

Last calibration date: unknown

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

WS Calibration Point	M/S Input	M/S Chart	M/S Diff. Chart	M/S DAS	M/S Diff. DAS	% Diff. DAS
1	0.0	#N/A	#N/A	0.0	0.0	#N/A
2	2.5	#N/A	#N/A	2.5	0.0	#N/A
3	7.4	#N/A	#N/A	7.4	0.0	0.0
4	12.3	#N/A	#N/A	12.3	0.0	0.0
5	22.1	#N/A	#N/A	22.2	0.1	0.5
6	34.3	#N/A	#N/A	34.3	0.0	0.0

Pass/Fail Criteria: +/-.25 m/s; ws <= 5 m/s
+/- 5%; ws > 5 m/s

Comments: Sensor passed criteria
The sensor is mounted on a 3 meter tripod on top of the building roof. The building will influence the measurements.

SCOS97-NARSTO AUDIT RECORD
HORIZONTAL WIND DIRECTION

Date: July 2, 1997
Start: 1045 PDT
Finish: 1100 PDT
Auditor: Bob Baxter

Site name: Cent LA (USC)
Project: SCOS97-NARSTO
Operator: NOAA/ETL
Site Operator: Clark King

Sensor Mfg: R.M. Young
Serial No.: 16348
K Factor: NA
Range: 0 - 355 deg
Logger: CR10
Logger s/n: X4762

Model: Wind Monitor
Sensor Ht.: ~18 m AGL
Starting torque: NA gm-cm
Starting threshold: #DIV/0! M/S

Last calibration date: unknown

Box: 173 deg true

Cal. Factors

	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

WD Audit Point	Degrees Reference	Corrected Degrees Reference	Degrees Chart	Diff. Chart Deg.	Degrees DAS	Linearity	Total Diff DAS Deg.
Orientation	173.0				179.7		6.7
1	30	23.3	#N/A	#N/A	29.0	-0.5	5.7
2	60	53.3	#N/A	#N/A	59.8	0.3	6.5
3	90	83.3	#N/A	#N/A	88.6	-0.9	5.3
4	120	113.3	#N/A	#N/A	118.2	-1.3	4.9
5	150	143.3	#N/A	#N/A	149.4	-0.1	6.1
6	180	173.3	#N/A	#N/A	179.7	0.2	6.4
7	210	203.3	#N/A	#N/A	209.2	-0.3	5.9
8	240	233.3	#N/A	#N/A	239.5	0.0	6.2
9	270	263.3	#N/A	#N/A	269.4	-0.1	6.1
10	300	293.3	#N/A	#N/A	299.6	0.1	6.3
11	330	323.3	#N/A	#N/A	332.5	3.0	9.2
				Avg difference:			6.2
				Maximum difference:		3.0	9.2

Criteria: Orientation: +/- 2 degrees
Linearity: +/- 3 degrees
Maximum Difference: +/- 5 degrees

Comments: Sensor passed linearity test but failed orientation criteria. The wind direction threshold could not be checked without taking the sensor down from the roof. The bearings felt smooth with no binding. Considering the site does not meet siting criteria and it will be used for QC of the radar winds only, no further effort was expended to document the starting threshold.
The sensor is mounted on a 3 meter tripod on top of the building roof. The building will influence the measurements. Note the "Corrected Degrees Reference" includes the offset

for the arbitrary markings on the sensor shaft.
The sensor orientation was corrected following the audit.

SCOS97-NARSTO AUDIT RECORD
AMBIENT TEMPERATURE

Date: July 2, 1997
Start: 1140 PDT
Finish: 1215 PDT
Auditor: Bob Baxter

Site name: Cent LA (USC)
Project: SCOS97-NARSTO
Operator: NOAA/ETL
Site Operator: Clark King

Sensor Mfg: Cambell Scientific
Serial No.: NA
Range: -35 - 50 Deg C

Model: 207
Sensor Ht.: 2 m abv roof

Logger: CR10
Logger s/n: X4762

Last calibration date: unknown

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

Temperature Audit Point	Deg C Input	Deg C Chart	Deg C Diff. Chart	Deg C DAS	Deg C Diff. DAS
1	4.7	#N/A	#N/A	5.0	0.3
2	25.7	#N/A	#N/A	25.6	-0.1
3	42.7	#N/A	#N/A	42.8	0.1

Criteria: +/- 0.5 degree Celsius

Comments: The sensor was immersed in a water proof sheath.
Sensor passed criteria.
The site is on top of a black roof that will cause inaccuracies in the measurements.

SCOS97-NARSTO AUDIT RECORD
RELATIVE HUMIDITY (DEW POINT TEMPERATURE)

Date: July 2, 1997
Start: 1130 PDT
Finish: 1130 PDT
Auditor: Bob Baxter

Site name: Cent LA (USC)
Project: SCOS97-NARSTO
Operator: NOAA/ETL
Site Operator: Clark King

Sensor Mfg: Campbell Scientific
Serial No.: unknown
Range: 0 - 100 Percent

Model: 207
Sensor Ht.: 2 m abv roof

Logger: CR10
Logger s/n: X4762

Last calibration date: unknown

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

RH/DP Audit Point	%RH Input	Deg C Input	% RH Chart	Deg C Chart	Deg C Diff. Chart	%RH DAS	Deg C DAS	Deg C Diff. DAS
1	44.9	15.5	#N/A	#N/A	#N/A	43.3	14.9	-0.6

Criteria: +/- 1.5 degree Celsius

Comments: Sensor passed.
The site is on top of a black roof that will cause inaccuracies in the measurements.

Usc

VALLEY CENTER (VLC)

SCOS97-NARSTO AUDIT SUMMARY
RADAR PROFILER/RASS/SODAR/SURFACE METEOROLOGY

Site:	Valley Center
Audit Dates:	7/19/97 to 7/20/97
Instrumentation Audited:	Radar Profiler, RASS, Surface Meteorology
Key Person(s):	Jean Timmerman
Auditor:	Alexander N. Barnett

The purpose of this summary is to provide a preliminary report of any significant audit findings. Key elements of the audit are identified below.

AUDIT INSTRUMENTATION

The site is a water district pump station that has eight 750 horse power motors operating pumps continuously. The noise from these pumps made it impossible to collect data with the sodar for comparison with the RWP wind data.

Four rawinsondes were released to collect the wind and virtual temperature data for comparison with the RWP winds and RASS virtual temperature profiles.

SITE CHARACTERISTICS

The site is located in a small canyon at the top of a hill. Hilltops line the site on the north to southeast side. An embankment approximately 20 feet high runs along the west and northwest sides of the site. The RWP is located 10 to 15 meters from the embankment on the west side of the compound. The pointing directions are north and west, over the embankment.

SYSTEM AUDIT NOTES

1. The surrounding hills and embankments present a potential to interfere with the wind data. Clutter is present in the lowest two to three range gates. This potential will be investigated further when the audit, RWP and RASS data are compared.
2. It is recommended that the hardware technicians mark the position of the RWP antenna foot pads to provide a quick check of the antenna orientation. Movement away from the marks will indicate that the antenna has moved and requires repositioning.
3. A procedure for filling out the site documentation (station log book and checklist) should be added to the SDAPCD RWP/RASS SOP to ensure that all actions are performed completely and consistently during each site check.

4. A procedure for checking the level and orientation of the RWP antenna, and the level of the RASS acoustic sources should be added to the SDAPCD RWP/RASS SOP to ensure that it is performed completely and consistently during each site check.
5. Ear protection should be provided. All persons working in close proximity to the antennas during the RASS data collection period should have appropriate ear protection to protect their hearing.

POTENTIAL ACTIVE NOISE SOURCES

No RFI was noted in a scan of the frequencies between 914 and 916 mHz.

POTENTIAL PASSIVE NOISE SOURCES

The hills and embankments that surround the site present potential reflective surfaces to the beams.

ANTENNA LEVEL AND ALIGNMENT

1. The RWP antenna alignment was set to 359° true, the audit measured pointing direction was determined to be 356° true, a difference of 3° true. The pointing direction was corrected following the audit. No further action is required.
2. The north acoustic source antenna level as found to be 1.5° in the east-west direction. This exceeded the audit criteria of ± 1.0°.

RADAR PROFILER PERFORMANCE AUDIT

RWP - Sodar Comparison

An audit comparison between the RWP and audit sodar winds was not possible. The site is a water pump station. Seven 750 horse power electric motors, that drive water pumps, operate continuously creating noise that made it impossible to collect data with the audit sodar.

RWP - Rawinsonde Comparison

Four rawinsondes were released in place of the usual two, to compensate for not being able to collect audit comparison data with the sodar. The soundings were conducted on 7/19/97 at 18:00 PDT, and 7/20/97 at 08:00 PDT, 11:00 PDT, and 14:00 PDT. The audit results were as follows:

	Low Mode		High Mode	
	WD (deg)	WS (m/s)	WD (deg)	WS (m/s)

Average Difference:	11	-0.9	0	-0.9
Standard Deviation:	45	1.2	40	1.5
Root Mean Squared:	46	1.5	39	1.7
Maximum Difference:	154	1.0	172	2.5
Minimum Difference:	-164	-4.8	-136	-4.9

The high and low mode wind speed average differences compared within the audit criteria of ± 1.0 m/s. The high mode wind direction average difference compared within the audit criteria of ± 10°, while the low mode wind direction average difference marginally did not (11°). A review of the wind direction profiles showed greater variation in the rawinsonde data at the lowest range gates up to approximately 1000 meters ASL. This had a greater affect on the overall average difference of the low mode than the high mode wind directions. The reason for this larger variation at the lower levels was probably due to the local effects of the terrain, including the three hill tops that surrounded the site, on the movements of the rawinsonde. The rawinsonde winds are determined by calculating the vectors from successive positions of the sonde measured by a Loran receiver. The rawinsonde can be rapidly accelerated and decelerated by the terrain features while the RWP concensus averaging tends to smooth out abrupt changes. It should be taken into account that the RWP wind data in the first 500 meters are probably affected by the terrain.

RASS PERFORMANCE AUDIT

The audit virtual temperature comparison data was provided by the pressure, temperature, and humidity data from the 7/17/97, 16:00 PDT, and 7/18/97, 10:00 rawinsonde soundings. The average difference for the soundings were well within the audit criteria of ± 1.0°C. The audit results were as follows:

	7/17/97 16:00 PDT (oC)	7/18/97 10:00 PDT (oC)
Average Difference:	0.7	0.6
Standard Deviation:	1.1	1.0
Maximum Difference:	1.2	1.0
Minimum Difference:	-0.4	-1.1

RADAR PROFILER DATA INTERNAL CONSISTENCY

1. Height coverage varied in the data available for this review, but may have been a product of the changing atmospheric humidity that occurred during the period of the audit. Data was gathered to the top range gate of the two modes of operation during the midday hours. Some missing data at the lower range gates may be due to clutter.

RASS DATA INTERNAL CONSISTENCY

1. During the period of the audit the vertical extent of the RASS data varied from about 500 meters to 1500 meters above ground level. Whether this was due to the current meteorological conditions is unknown.
2. The limited data reviewed during the audit looked reasonable. However, it is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 104 m. The finer resolution will remove some of the spatial averaging and provide a much clearer picture of the atmosphere. When changing the resolution, the height range should be maintained by increasing the number of range gates collected.
3. The lowest range gate frequently produces very high virtual temperature values that have to be edited by the SDAPCD staff. It is not clear what is producing this spurious data. Further investigation of the problem may be necessary to determine the cause.

SURFACE METEOROLOGICAL MEASUREMENTS

No surface measurements at this site.

SCOS97-NARSTO

SITING AND SYSTEM AUDIT FORM

MEASUREMENTS GROUP:	SDAPCD
SITE NAME AND LOCATION:	Valley Center (VLC)
AUDITOR:	Alexander N. Barnett
DATE:	July 19, 1997
KEY PERSON:	Jean Timmerman

I. Observables

A. Meteorological

Observable	Method	Manufacturer	Model	Serial #	Range
Wind Speed/ Wind Direction	Radar Profiler	Radian	LAP-3000	NA	Lo 552 - 1872 m asl at 54 m inc. Hi 559 - 2868 m asl at 96 m inc.
Virtual Temperature	RASS	Radian	LAP-3000	NA	527 - 2523 m at 104 m asl inc. (see below)
RASS Amp.	Audio amplifier	Peavey	CS-800x	NA	NA
10 m Wind Speed	Propeller	NA			
10 m Wind Direction	Vane	NA			
2 m ambient temperature	RTD	NA			
2 m relative humidity	Solid State	NA			
Data Logging	Digital	NA			

Comments:

1.

Are there any required variables which are not measured? No

Are there any methods and/or equipment that are not in the SOP? No

Do any operating ranges differ from those specified in the SOP? No

Are there any significant differences between instrumentation on site and the SOP? No

Comments:

1. It is recommended that the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.
2. Serial numbers not available because we did not want to move the components and take the chance of disturbing the set ups.

B. Auxiliary Equipment

Type	Manufacturer	Model	Serial #	Last Calibration Date
Communications computer	Advantech	Industrial 610	NA	NA
RWP computer	Advantech	Industrial 610	NA	NA
RASS amplifier	Peavey	CS 800x	NA	NA
Phone boot sys.	Teleboot	NA	NA	NA
Surge Protector	Tripplite	Isotel Ultra 6	NA	NA
Backup Device	Conner[1]	Tape Drive	NA	NA

Comments:

1. Backup is a portable unit that is brought to the site every six weeks for the data backup.

B. Station Check Equipment

Type	Manufacturer	Model	Serial #	Comments
NA[1]	NA	NA	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA

Comments:

1. Station check equipment is carried with the SDAPCD technicians and not left on site.

II. Sensor/Probe height and Exposure

A. Radar Profiler/RASS/Sodar

Variable	Value	Meet SOP (Yes/No)
1. Orientation	Radar – 3°	No
2. Level (level and inclination of the horiz ant)	Radar – 0.2°,0.3° RASS – 1.5°	Yes No
3. Distance to closest obstruction	Not significant	Yes
4. Distance to closest active noise source	No active RF sources between 914 and 916 mHz	Yes

Comments:

1. The orientation of one of the radar profiler antennas was off by 3°.
2. The north RASS dish was out of level by 1.5°.

B. Surface Meteorology

Variable	Value	Meet SOP (Yes/No)
1. Height of wind sensors above ground	NA	
2. Distance to nearest obstacle	NA	
3. Is separation at least 10x obst. Height?	NA	
4. Are instruments on a rooftop?	NA	
5. Is exposure 1.5x height above roof	NA	
6. Arc of unrestricted flow	NA	
7. Height of temp sensor above ground	NA	
8. Distance of temp sensor from obst.	NA	
9. Height of DP/RH sensor above ground	NA	
10. Distance of DP/RH sensor from obst.	NA	
11. Are the distances 4x the obst. height?	NA	
12. Is the sensor shielded or aspirated?	NA	
13. Are the T/DP/RH abv representative terrain?	NA	
14. Are there significant differences between on-site equipment and the monitoring plan?	NA	

Comments: No surface meteorological measurements.

III. Operation

A. Radar Profiler, RASS and Surface Meteorology

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is all instrumentation operational?	Yes	Yes
2. Are all cables secure?	Yes	Yes
3. Are all cables connected according to SOPs or instrument manuals?	Yes	Yes
4. Are connections clean and rust free?	Yes	Yes
5. Are serial numbers available?	No	Yes
6. Do data system times agree with audit times. If not, what is the deviation?	Yes	Yes
7. Is the printer functional?	NA	NA
8. Overall, is the site maintenance sufficient to meet the DQOs?	See below	Yes

Comments:

5. It was decided not to move the RWP and RASS components to find the serial numbers and risk interrupting the RWP and RASS operations.
6. RWP and gateway computer clocks are within 15 seconds of each other. The RWP and gateway computer clocks are within 2 minutes of the atomic clock.
8. The site is visited approximately every three weeks for routine maintenance. There is a potential for problems to occur such as RASS source failure that would go unnoticed for up to three weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

B. Radar Profiler/RASS/Sodar Settings

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Software version	POP 4.1	Yes
2. High mode pulse length	700 ns	Yes
3. Low mode pulse length	400 ns	Yes
4. RASS pulse length	700 ns	Yes
5. RASS acoustic temperature Range?	0.08 - 44.66°C	Yes
6. RASS acoustic source range?	5.11 - 39.96°C	Yes
7. Time zone	PST	Yes
8. Wind data consensus	55 min	Yes
9. RASS consensus	5 min	Yes

Comments:

	Wind Low Mode	Wind High Mode	RASS
First Gate	552 m	559 m	527 m
Last Gate	1872 m	2868 m	2523 m
Pulse Length	54 m	96 m	104 m
Spacing	54 m	96 m	104 m
Full Scale Velocity	10.5 m/s	10.5 m/s	409.8 m/s

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

B. Auxiliary Equipment

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is the A/C unit sufficient to maintain temperatures in the range specified in the SOPs?	No	No
2. Is the site temperature recorded?	No	See below
3. Is the site temperature maintained at 20-30°C?	No	See below
4. Is the site kept clean enough to allow operation of all instruments as specified in the SOP?	Yes	Yes
5. Does the modem work?	Yes	Yes
6. Does the telephone work?	Yes	Yes
7. Is the site secure?	Yes	Yes
8. Overall, is the auxiliary equipment maintenance sufficient to meet the DQOs?	Yes	Yes

Comments:

2. There is no measurement of the shelter temperature. It was indicated that the temperature is not critical for the system operation.

1,3. The air conditioner malfunctioned. Word has been past to the SDAPCD technicians to fix this problem.

C. Station Check Procedures and Documentation

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Are the station logs present?	Yes	Yes
2. Are the station logs up to date?	Yes	Yes
3. Do station logs contain details as required by the SOPs?	Yes	Yes
4. Are routine checklists used?	Yes	Yes
5. Do the routine checklists contain details as required by the SOPs?	Yes	Yes
6. Are the calibration forms present?	NA	NA
7. Do the calibration forms contain details as required by the SOPs?	NA	NA
8. Are the SOPs present?	No	No
9. Are the instrument manuals present?	No	See below
10. Do the SOPs include quality control tests?	Yes	Yes
11. If quality control tests are included then how are the results of the tests documented?	In site checklist	Yes
12. Has the site technician undergone training as specified in the SOPs?	Yes	Yes
13. Is the site visited twice weekly?	No	See below
14. Does the site technician understand the SOPs?	Yes	Yes (see below)

Comments:

8. SOPs should be kept at the site for reference of all personnel who visit the site.
9. Manuals are maintained at SDAPCD. If repairs are needed then the technician brings the manuals to the site.
10. There are hardware technicians and a software specialist. The hardware technicians visit the site every three weeks to verify the antenna and RASS source set ups and condition and to ensure that they are functioning properly. The software specialist visits the site every 6 weeks to back up the data and to ensure that the profiler controller and computers are operating properly. It is also the software specialist's duty to review the data three times daily to detect malfunctions in a timely manner.

13, 14. The site is visited approximately every three weeks for routine maintenance. In between the visits the data are polled and reviewed on a regular basis. Data are retrieved hourly and reviewed three times daily. There is a potential for problems to occur such as RASS source failure that would go unnoticed for up to three weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

D. Chain of Custody

1. Review paper work for chain of custody from field to data processing.	Comments: The checklist data backup and transfer information. This is a new procedure that is now in place.
2. How are data stored?	Data are stored locally on the computer hard drive with consensus files and surface data transferred on an hourly basis to the communications computer. The files on the communications computer are downloaded to SDAPCD on an hourly basis and then erased.
3. How often are the data backed up?	Files are copied to a portable tape backup drive every six weeks and taken back to the SDAPCD offices by the software specialist.

Comments:

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is preventive maintenance discussed in the SOPs?	Yes	Yes
2. Is preventive maintenance being performed?	Yes	Yes
3. Are field operators given special training in preventive maintenance?	Yes	Yes
4. Are tools and spare parts adequate at the site to meet the requirements of the SOPs?	See below	Yes
5. Are maintenance logs maintained and reviewed?	Yes	Yes

Comments:

4. Tools and spares are carried with the field technicians.

VI. Overall Comments

Question	Response (Yes/No)	Meet Work Plan (Yes/No)
1. Overall, is the station maintenance sufficient to meet the DQOs?	Yes	Yes
2. Does the siting meet the program objectives?	Yes	Yes
3. Overall, is the site technician trained as specified in the SOPs?	Yes	Yes
4. Does the QC program appear to be working?	Yes	Yes
5. Overall, does the meteorological data look reasonable?	Yes	See below
6. Overall, does the data appear to meet the program objectives?	Yes	Yes

Comments:

5. During the period of the audit the vertical extent of the RASS data looked limited. Whether this was due to the current meteorological conditions or the partially covered RASS source dish on the north side is unknown. A review of RASS data collected over the last 4 to 5 days showed a capability to about 800 meters, on the average. It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 106 m. The finer resolution will remove some of the spatial averaging and provide a much clearer picture of the atmosphere. When changing the resolution, the height range should be maintained by increasing the number of range gates collected.

SCOS97-NARSTO AUDIT RECORD
VISTA, ORIENTATION AND LEVEL

Site Name:	Point Loma	Instrument:	LAP-3000
Date:	7/19/97 - 7/20/97	Receiver s/n:	NA
Time:	15:00 PDT	Interface s/n:	NA
Measurements group:	SDAPCD	Frimware version:	POP-4.1
Key contact:	Jean Timmerman	System rotation angle:	359° True
Audited by:	Alex Barnett	Measured orientation:	356° True
Site longitude:	117° 02.62'W	Orientation difference:	3°
Site latitude:	33° 15.34'N	Array level:	N-S: 0.2° E-W: 0.3°
Site elevation:	415 meters	Beam zenith angle:	23.6°
Magnetic declination:		Beam directions:	North and West

Mag. Az. Angle (deg)	True Az. Angle (deg)	Terrain El. Angle (deg)	Features and Distances
NA	0	35	Embankment at 30 meters.
NA	30	40	Hill at 300 meters.
NA	60	40	Hill at 200 meters.
NA	90	40	Hill at 200 meters.
NA	120	35	Hill at 200 meters.
NA	150	10	Hill at 400 meters.
NA	180	10	Hill at 75 meters.
NA	210	15	Hill at 75 meters.
NA	240	20	Embankment at 15 meters.
NA	270	35	Embankment at 15 meters.
NA	300	35	Embankment at 20 meters.
NA	330	35	Embankment at 30 meters.

Comments:

SCOS97-NARSTO Audit Report
Radar Profiler - Rawinsonde Wind Comparison

Site: Valley Center
Date: July 19 - 20, 1997
Measurements Group: SDAPCD
Radar Profiler: Radian LAP-3000
Audit Rawinsonde: VIZ Model W-9000

High Mode Overall Difference RWP - Rawinsonde	Wind Speed (m/s)
Average:	-0.6
Maximum:	2.8
Minimum:	-4.3
Standard Deviation:	1.5
Root Mean Square:	1.6

High Mode Overall Difference RWP - Rawinsonde	Wind Direction (deg)
Average:	4
Maximum:	147
Minimum:	-143
Standard Deviation:	37
Root Mean Square:	37

WS Difference (m/s)				
Altitude	7/19/97 1800	7/20/97 800	7/20/97 1100	7/20/97 1400
559				
656	-2.6			-0.6
752	-1.5	-1.5		0.0
848	-0.9		-2.3	
944	1.2		-1.7	-2.0
1040	-1.5			
1137	-1.1			
1233		1.5	0.7	-0.9
1329	1.4	1.7	-0.1	-0.2
1425	0.8	1.6	0.0	0.6
1521	-0.7	0.7	0.1	0.6
1618	-2.1	0.9	-0.6	-0.9
1714	-3.1	1.2		-0.8
1810	-3.9	0.3		0.3
1906	-4.3	0.6	-0.5	0.1
2002	-4.2	1.1	0.0	0.0
2099	-3.9	1.1	-0.8	0.6
2195	-3.1	0.2	-0.3	-0.1
2291	-1.9	-1.5	1.1	0.1
2387		-3.4	0.2	
2484		-1.4	-0.3	-0.3
2580	-1.0	-1.9	0.9	-0.8
2676	-2.1	-1.1	2.8	-1.0
2772	-3.1	0.2	1.3	-1.0
2868		2.4		-0.7
Average:	-1.9	0.1	0.0	-0.4
Maximum:	1.4	2.4	2.8	0.6
Minimum:	-4.3	-3.4	-2.3	-2.0
Std Dev:	1.7	1.5	1.2	0.7
RMS:	2.5	1.5	1.1	0.7

WD Difference (deg)				
Altitude	7/19/97 1800	7/20/97 800	7/20/97 1100	7/20/97 1400
559				
656	-143			9
752	147	-15		-74
848	98		49	
944	17		0	100
1040	44			
1137	68			
1233		37	0	57
1329	38	20	5	1
1425	26	1	3	1
1521	24	-11	8	42
1618	20	-8	11	41
1714	-13	-12		14
1810	-34	-11		9
1906	-39	-9	-8	7
2002	-48	-7	-4	0
2099	-51	-6	-3	5
2195	-43	-5	-5	4
2291	-32	-7	-2	-1
2387		-4	2	
2484		3	4	1
2580	-14	3	6	-1
2676	-19	4	14	-1
2772	-17	-2	6	-1
2868		-8		-5
Average:	1	-2	5	10
Maximum:	147	37	49	100
Minimum:	-143	-15	-8	-74
Std Dev:	62	12	13	33
RMS:	60	12	13	34

SCOS97-NARSTO Audit Report
Radar Profiler - Rawinsonde Wind Comparison

Site: Valley Center
Date: July 19 - 20, 1997
Measurements Group: SDAPCD
Radar Profiler: Radian LAP-3000
Audit Rawinsonde: VIZ Model W-9000

Low Mode Overall Difference RWP - Rawinsonde	Wind Speed (m/s)
Average:	-0.9
Maximum:	1.0
Minimum:	-4.8
Standard Deviation:	1.2
Root Mean Square:	1.5

Low Mode Overall Difference RWP - Rawinsonde	Wind Direction (deg)
Average:	11
Maximum:	154
Minimum:	-164
Standard Deviation:	45
Root Mean Square:	46

	WS Difference (m/s)			
Altitude	7/19/97 1800	7/20/97 800	7/20/97 1100	7/20/97 1400
552		-1.8		
607	-1.5			0.4
662	-1.2	-2.0	-0.1	0.3
717	-2.6	-1.6	-0.3	0.0
772			-1.8	
827			-1.8	
882	0.4		-2.1	-0.5
937	1.0			-2.2
992	-0.5	-0.4		-1.7
1047		-1.2		-0.1
1102		-1.0	-1.7	
1157		-1.0	-1.9	-0.6
1212	-0.3	0.1	-1.7	-0.8
1267	0.4	0.6	-0.5	-0.3
1322	0.9	0.8	-0.4	
1377	1.0	-0.5	0.2	
1432	0.0	-0.3	0.4	0.6
1487	-0.4	0.1		-0.5
1542	-1.2	-0.4		-1.2
1597	-2.9	-0.5		-2.1
1652	-3.5	-0.6		-1.7
1707	-4.0	-0.9		-0.9
1762	-4.8	-1.0		0.0
1817	-4.6	-1.2		0.0
Average:	-1.3	-0.7	-1.0	-0.8
Maximum:	1.0	0.8	0.4	0.6
Minimum:	-4.8	-2.0	-2.1	-2.2
Std Dev:	2.0	0.7	0.9	0.9
RMS:	2.3	1.0	1.3	1.0

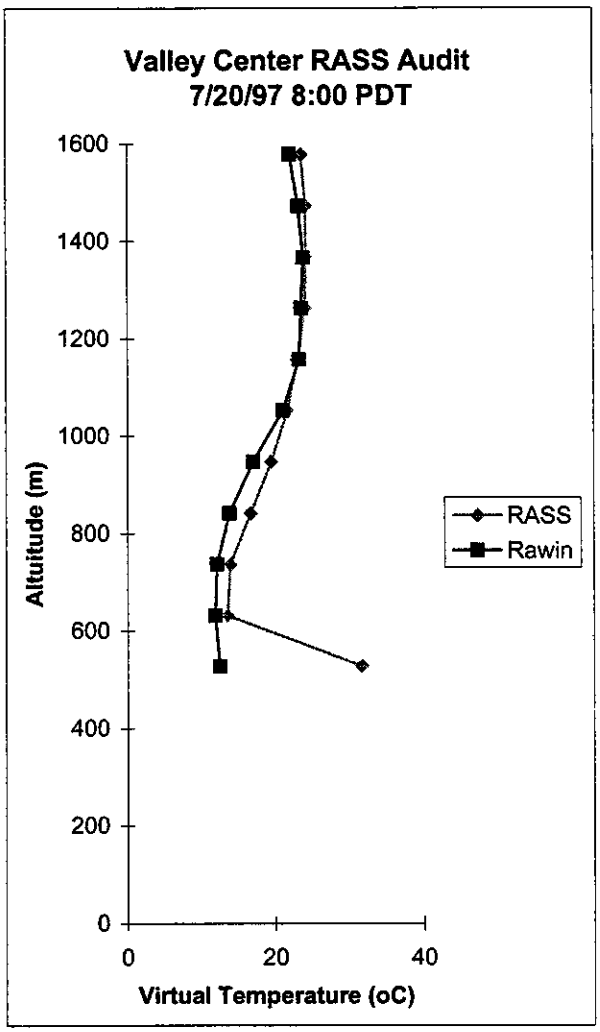
	WD Difference (deg)			
Altitude	7/19/97 1800	7/20/97 800	7/20/97 1100	7/20/97 1400
552		154		
607	28			-30
662	-10	-33	80	-45
717	41	6	90	-1
772			78	
827			83	
882	-53		62	-164
937	-37			110
992	27	-2		24
1047		-2		10
1102		-47	15	
1157		3	16	-69
1212	30	8	12	-33
1267	33	5	13	-3
1322	29	10	13	
1377	39	-1	9	
1432	36	-1	14	69
1487	34	1		61
1542	37	-8		48
1597	11	-8		40
1652	-11	-11		27
1707	-28	-13		17
1762	-35	-7		15
1817	-34	-4		12
Average:	8	3	40	5
Maximum:	41	154	90	110
Minimum:	-53	-47	9	-164
Std Dev:	33	39	34	60
RMS:	33	38	52	59

Date: 7/20/97
Start: 8:00 PDT
End: 8:39 PDT
Key Person: Jean Timmerman
Auditor: Alex Barnett

Site Name: Valley Center
Project: Upper-Air Audit
Measurement Org.: SDAPCD

Instrument: Radian LAP-3000

RASS Alt (m)	RASS Tv (oC)	Airsonde Tv (oC)	Diff. (oC)
1578	23.6	22.1	1.5
1472	24.2	23.2	1.0
1367	24.2	23.9	0.3
1262	24.1	23.6	0.5
1157	23.1	23.3	-0.2
1052	21.7	21.1	0.6
947	19.5	17.1	2.5
842	16.7	13.8	2.9
737	13.9	12.1	1.8
632	13.5	11.9	1.6
527	31.7	12.5	19.2



Results Summary

Min. Diff. :	-0.2
Max Diff. :	19.2
Ave. Diff. :	2.9
Std. Dev. :	5.5

Audit Criteria: +/- 1oC

Audit Sonde Data
Sonde Serial # : 2000753

Td offset (oC):	-0.4
RH offset (%)	-8.0
Sonde Pressure (mb):	967.6
Ref Pressure (mb):	967.0
Difference (mb):	0.6

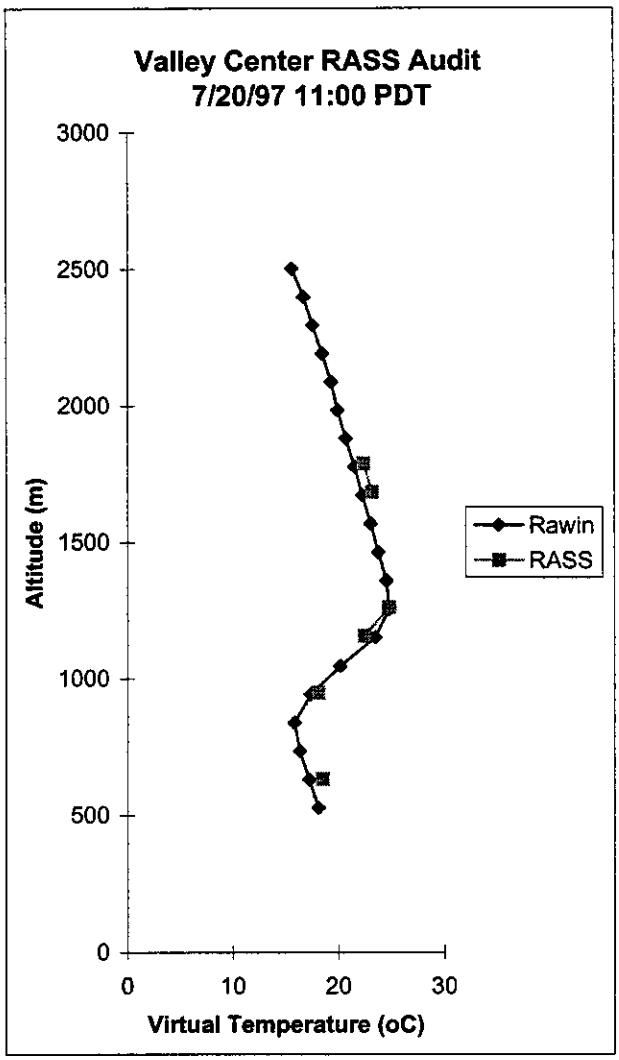
Comments: The sonde data was vertically averaged to match the RASS levels.
The sonde Td and Tw offsets were included in the Tv calculations.

Date: 7/20/97
Start: 1:00 PDT
End: 1:24 PDT
Key Person: Jean Timmerman
Auditor: Alex Barnett

Site Name: Valley Center
Project: Upper-Air Audit
Measurement Org.: SDAPCD

Instrument: Radian LAP-3000

RASS Alt (m)	RASS Tv (oC)	Airsonde Tv (oC)	Diff. (oC)
1787	22.4	21.5	0.9
1683	23.2	22.3	0.9
1578	9999	23.1	NA
1473	9999	23.8	NA
1367	9999	24.6	NA
1263	24.8	24.8	0.0
1158	22.5	23.5	-1.0
1052	9999	20.2	NA
948	18.1	17.4	0.7
843	9999	15.8	NA
737	9999	16.4	NA
633	18.5	17.2	1.3
527	9999	18.1	NA



Results Summary

Min. Diff. :	-1.0
Max Diff. :	1.3
Ave. Diff. :	0.5
Std. Dev. :	0.8

Audit Criteria: +/- 1oC

Audit Sonde Data
Sonde Serial # : 1554895

Td offset (oC):	-0.7
RH offset (%)	-15.0
Sonde Pressure (mb):	967.6
Ref Pressure (mb):	966.2
Difference (mb):	1.4

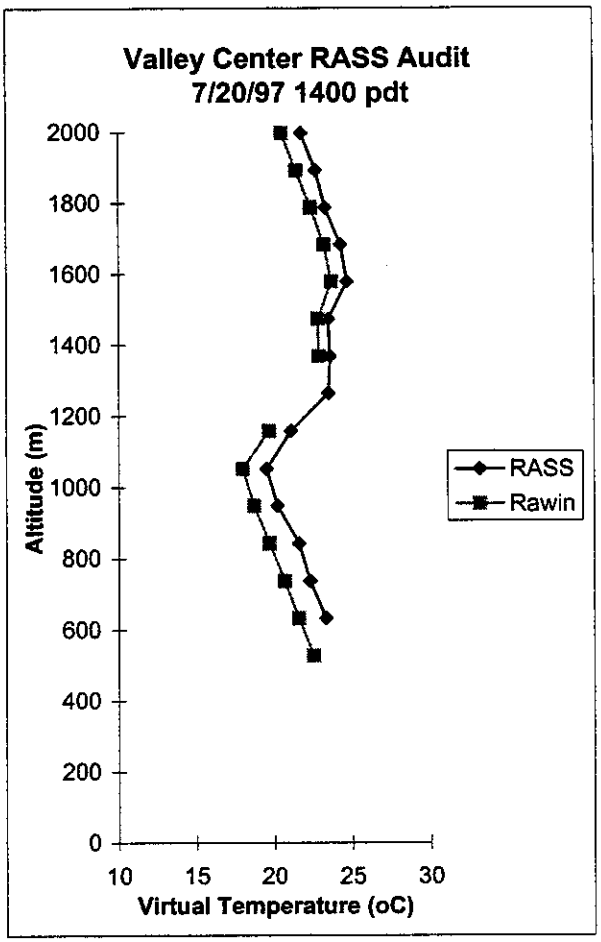
Comments: The sonde data was vertically averaged to match the RASS levels.
The sonde Td and Tw offsets were included in the Tv calculations.

Date: 7/20/97
Start: 4:00 PDT
End: 4:34 PDT
Key Person: Jean Timmerman
Auditor: Alex Barnett

Site Name: Valley Center
Project: Upper-Air Audit
Measurement Org.: SDAPCD

Instrument: Radian LAP-3000

RASS Alt (m)	RASS Tv (oC)	Airsonde Tv (oC)	Diff. (oC)
1997	21.8	20.5	1.3
1892	22.7	21.5	1.2
1787	23.3	22.4	0.9
1683	24.3	23.2	1.1
1578	24.7	23.7	1.0
1473	23.5	22.8	0.7
1367	23.6	22.9	0.7
1263	23.5	9999	NA
1158	21.1	19.7	1.4
1052	19.5	18.0	1.5
948	20.2	18.7	1.5
843	21.6	19.7	1.9
737	22.3	20.7	1.6
633	23.3	21.6	1.7
527	9999	22.5	NA



Results Summary

Min. Diff. :	0.7
Max Diff. :	1.9
Ave. Diff. :	1.2
Std. Dev. :	0.4

Audit Criteria: +/- 1oC

Audit Sonde Data

Sonde Serial # :	2000619
Td offset (oC):	-0.4
RH offset (%)	-9.0
Sonde Pressure (mb):	966.3
Ref Pressure (mb):	965.8
Difference (mb):	0.5

Comments: The sonde data was vertically averaged to match the RASS levels.
The sonde Td and Tw offsets were included in the Tv calculations.

VAN NUYS (VNE)

SCOS97-NARSTO AUDIT SUMMARY
RADAR PROFILER/RASS/SODAR/SURFACE METEOROLOGY

Site:	Van Nuys (VNE)
Audit Dates:	July 10, 1997
Instrumentation Audited:	Radar Profiler, RASS, Surface Meteorology
Key Person(s):	Scott Abbott
Auditor:	Alexander N. Barnett

The purpose of this summary is to provide a preliminary report of any significant audit findings. The site is operated by NOAA/ETL. Key elements of the audit are identified below.

AUDIT INSTRUMENTATION

No problems were encountered with the audit instrumentation.

SITE CHARACTERISTICS

The site is on the west side of the Van Nuys Airport main runway, approximately 400 meters from the north end of the runway. It is situated at the base of the former control tower for the Van Nuys Air National Guard Base. The pointing direction of the oblique antennas are northeast and southeast to face away from the tower.

SYSTEM AUDIT NOTES

1. The temperature and relative humidity sensors are in a non-aspirated radiation shield. The data should therefore not be used in dispersion modeling.
2. There are no signs warning of potential audio or radio frequency radiation. Appropriate signage is recommended.
3. The cables that connect the RWP and RASS controllers to the antennas and acoustic sources run along the ground and are not marked. Marker flags should be installed to prevent stepping on and possible damaging the cables.
4. The radar transmitter modules were resting on the ground under the two oblique antennas. It is recommended they be mounted off the ground to prevent moisture entry or other problems with it on the ground.

5. The site is visited approximately once every four weeks. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

POTENTIAL ACTIVE NOISE SOURCES

Listen only tests showed no active sources.

POTENTIAL PASSIVE NOISE SOURCES

No passive sources were noted.

ANTENNA LEVEL AND ALIGNMENT

1. The level of the south and west RASS acoustic source dishes were outside of the audit criteria of ±1.0°. The south dish was out of level by 1.7° , and the west dish was out of level by 1.3°. The dishes were leveled following the audit.
2. The southeast beam radar orientation differed from the audit measurement by 6°. The difference was verified and a change in the system setup made following the audit.

RADAR PROFILER PERFORMANCE AUDIT

Not applicable (no performance audit performed).

RASS PERFORMANCE AUDIT

Not applicable (no performance audit performed).

RADAR PROFILER DATA INTERNALCONSISTENCY

Overall, the data look reasonable. Comparisons to surface winds collected during the same reviewed periods showed reasonable results in both speed and direction. The low mode of operation is collecting data to approximately 2,000 meters while the high mode of operation is collecting data to between 2,300 and 3,000 meters.

RASS DATA INTERNAL CONSISTENCY

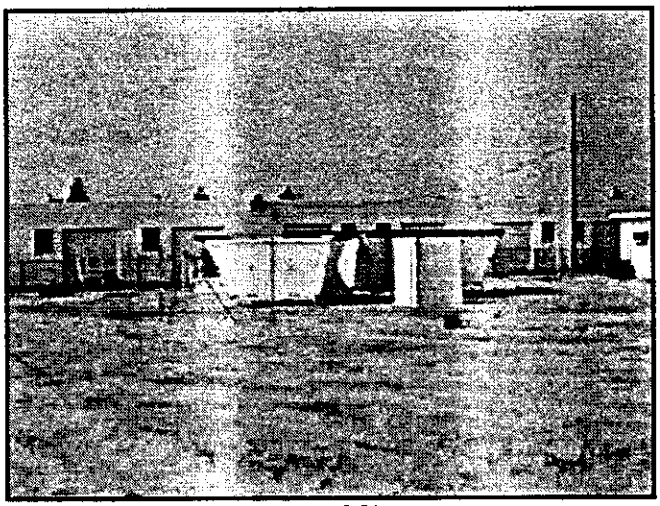
1. During the period of the audit the vertical extent of the RASS data looked limited. Whether this was due to the current meteorological conditions or because of noise levels at the site is unknown. A review of the RASS data collected over the last 3 days showed a capability to about 800 meters, on the average.
2. Surface temperatures increase to a maximum during the nighttime hours and decrease until about noon. The virtual temperature profiles show a decrease with height during the morning hours and an elevated inversion in the afternoon. This may be a product of the arrival of the sea breeze front that normally arrives at the site around noon from the southeast. The reason for the very high surface temperatures around midnight (27 - 28°C) should be investigated.

3. It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 106 m. This will remove some of the spatial averaging and provide a much clearer picture of the atmosphere. When changing the resolution, the height range should be maintained by increasing the number of range gates collected.

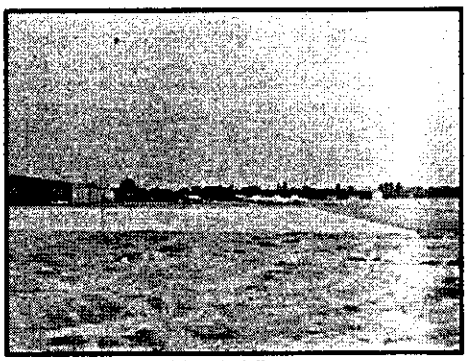
SURFACE METEOROLOGY PERFORMANCE AUDIT

1. The 10 meter wind direction sensor orientation was outside of criteria which produced a total error of 9°. The sensor was aligned following the audit and the alignment verified.
2. The dew point temperature calculated from the site relative humidity, and ambient temperature sensing systems differed from the audit determined dew point temperature by more than the EPA recommended criteria of ± 1.5°C. The relative humidity sensing system should be checked and the problem corrected as soon as possible.
3. All sensors are scanned every 10 seconds with five minute averages recorded. Other than the wind direction alignment error and the problem with the relative humidity sensing system noted above, no problems were noted with the performance audit results. However, not all of the variables could be audited completely. A summary of these audits are provided below:
    - The temperature sensor could not be immersed in water and the probe design was not conducive to placement in a water proof sheath while retaining good thermal conductivity. Only one ambient comparison point was therefore audited.
    - Due to the wiring and the method of sensor installation, the wind direction or wind speed sensors were not removed from the tower to perform the torque tests. Future installations should consider an alternate installation that will allow for appropriate sensor evaluation.
    - Wind data recorded include scalar wind speed and resultant vector wind direction.
    - As indicated above, the 10 meter wind direction sensor orientation was outside of criteria which produced a total error of 9°. The sensor was aligned following the audit and the new alignment verified.

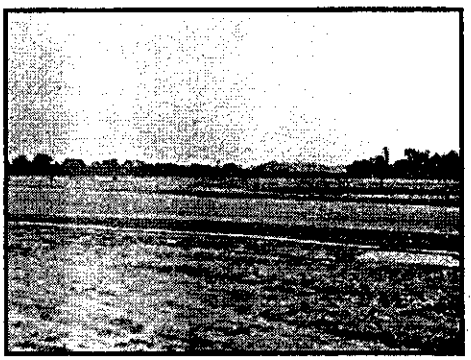
Van Nuys Airport
Site Photographs



View of Site

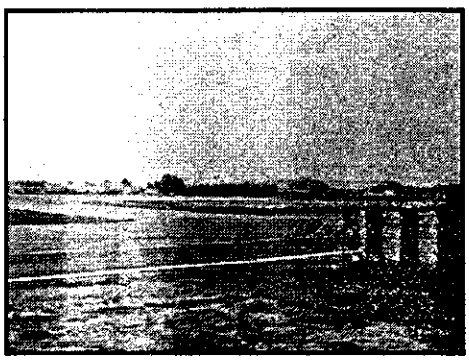


North View

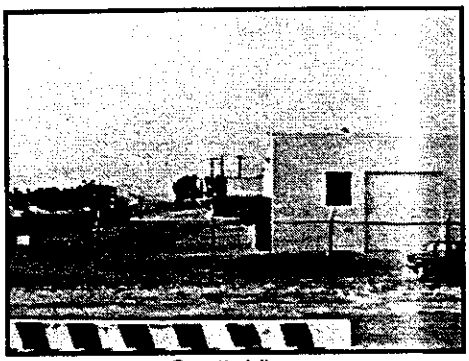


Northeast View

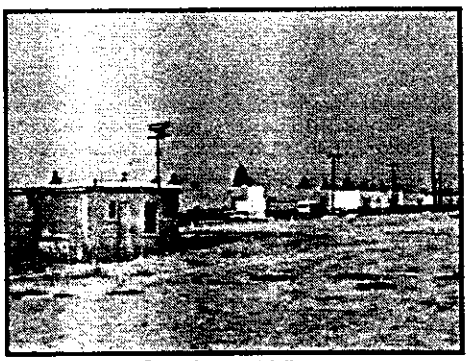
East View



Southeast View

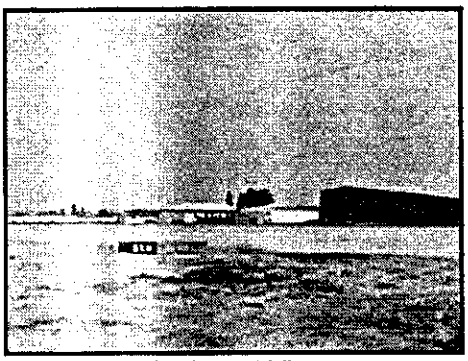


South View



Southwest View

West View



Northwest View

SCOS97-NARSTO

SITING AND SYSTEM AUDIT FORM

MEASUREMENTS GROUP:	NOAA/ETL
SITE NAME AND LOCATION:	Van Nuys (VNS)
AUDITOR:	Alexander N. Barnett
DATE:	July 10, 1997
KEY PERSON:	Scott Abbott

I. Observables

A. Meteorological

Observable	Method	Manufacturer	Model	Serial #	Range
Wind Speed/ Wind Direction	Radar Profiler	NOAA/ETL	915 MHz	915-32-8	Lo 152 - 2296 m at 58 m inc. Hi 152 - 3905 m at 102 m inc.
Virtual Temperature	RASS	NOAA/ETL	915 MHz	915-32-8	157 - 1628 m at 105 m inc. (see below)
	Audio amplifier	Crest Audio	NA	NA	NA
10 m Wind Speed	Propeller	RM Young	5103-AQ		0 - 50 m/s
10 m Wind Direction	Vane	RM Young	5103-AQ		0 - 355 degrees
2 m ambient temperature	RTD	CSI	CS2075713	NA	-35 - 50 °C
2 m relative humidity	Solid State	CSI	CS2075713	NA	0 - 100%
Data Logging	Digital	CSI	CR-10WP	NA	NA

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

Are there any required variables which are not measured? No

Are there any methods and/or equipment that are not in the SOP? Yes

Do any operating ranges differ from those specified in the SOP? See Below

Are there any significant differences between instrumentation on site and the SOP? No

Comments: Station is also monitoring total solar and net radiation and barometric pressure. As indicated above the RASS resolution should be increased to about 60 m.

B. Auxiliary Equipment

Type	Manufacturer	Model	Serial #	Last Calibration Date
Communications computer	SMT	NA	NA	NA
RWP computer	Diversified Technology	CRM 714	13157	NA
RASS amplifier	Crown	Com-Tech 400	NA	NA
Power conditioner	Best	ME1.4kva	ME1.4k05923	NA
Optical WORM drive	NA	NA	NA	NA

Comments:

B. Station Check Equipment

Type	Manufacturer	Model	Serial #	Comments
NA[1]	NA	NA	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA

Comments:

1. Station check equipment is carried with the NOAA engineers and not left on site.

II. Sensor/Probe height and Exposure

A. Radar Profiler/RASS/Sodar

Variable	Value	Meet SOP (Yes/No)
1. Orientation (three axis radar antenna)	Radar – 6°, 1° 10 m Vane – 9°	No No
2. Level (level and inclination of the horiz ant)	Radar -- 0.5° RASS – 1.7°	Yes No
3. Distance to closest obstruction	Not significant	Yes
4. Distance to closest active noise source	No significant active RF sources	Yes

Comments:

1. The orientation of one of the radar profiler antennas was off by 6°. There was a discrepancy between the readings of the auditor and site operator on the actual directions. This was resolved through a series of comparisons and identifying a potential nonlinearity and/or magnetic interference in the electronic compass used by the site operator. The audit values referenced the readings to solar observations. The 10 meter wind vane was also outside orientation criteria for the same reason.
2. The south RASS dish was out of level by 1.7°. The west RASS dish was out of level by 1.3°.
4. A listen only test of the radar revealed no significant RF sources nearby.

B. Surface Meteorology

Variable	Value	Meet SOP (Yes/No)
1. Height of wind sensors above ground	10 m	Yes
2. Distance to nearest obstacle	30 m	see below
3. Is separation at least 10x obst. height?	No	Yes
4. Are instruments on a rooftop?	No	NA
5. Is exposure 1.5x height above roof	NA	NA
6. Arc of unrestricted flow	300°	see below
7. Height of temp sensor above ground	2 m	Yes
8. Distance of temp sensor from obst.	No	No
9. Height of DP/RH sensor above ground	2 m	Yes
10. Distance of DP/RH sensor from obst.	No	No
11. Are the distances 4x the obst. height?	No	see below
12. Is the sensor shielded or aspirated?	Shielded	Yes
13. Are the T/DP/RH abv representative terrain?	Yes	Yes
14. Are there significant differences between on-site equipment and the monitoring plan?	No	Yes

Comments: 2, 3, 6. A tower to the west obstructs the flow. The height of the tower is approximately 30 m and is about is about 30 meters away from the instrument tower.

Wind data recorded include scalar wind speed and resultant vector wind direction. All surface sensors are scanned every 10 seconds with five minute averages recorded.

8, 10, 11. The temperature and relative humidity sensors are less than 4x the height of the instrument shelter from the shelter. The proximity of the instrument shelter may influence the temperature and relative humidity measurements by obstructing the flow of air around the sensors.

12. The temperature and relative humidity sensors are in a non-aspirated radiation shield. The data should therefore not be used in dispersion modeling.

III. Operation

A. Radar Profiler, RASS and Surface Meteorology

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is all instrumentation operational?	Yes	Yes
2. Are all cables secure?	Yes	Yes
3. Are all cables connected according to SOPs or instrument manuals?	Yes	Yes
4. Are connections clean and rust free?	Yes (see below)	Yes
5. Are serial numbers available?	See below	NA
6. Do data system times agree with audit times. If not, what is the deviation?	Yes	Yes
7. Is the printer functional?	NA	NA
8. Overall, is the site maintenance sufficient to meet the DQOs?	See below	Yes

Comments:

4. The radar transmitter module was resting on the ground under two of the antennas. It is recommended it be mounted off the ground to prevent moisture entry or other problems with it on the ground.

5. Did not want to move equipment to get serial numbers.

8. The site is visited approximately every four weeks for routine maintenance. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

B. Radar Profiler/RASS/Sodar Settings

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Software version	POP 4.1	Yes
2. High mode pulse length	700 ns	Yes
3. Low mode pulse length	400 ns	Yes
4. RASS pulse length	700 ns	Yes
5. RASS acoustic temperature Range?	10 - 40°C	Yes
6. RASS acoustic source range?	10 - 40°C	Yes
7. Time zone	GMT	Yes
8. Wind data consensus	55 min (see below)	Yes
9. RASS consensus	5 min (see below)	Yes

Comments:

8, 9. The configuration indicated gave a 55 minute wind data consensus but because of the polling of the surface data during the first five minutes of the hour only gave about a 3.5 minute RASS consensus. Following the audit the RASS, the consensus was increased to 7 minutes to effectively provide a 5.5 minute consensus period (allowing the 1.5 minutes for the surface data polling). This also reduced the wind data consensus from 55 to 53 minutes.

	Wind Low Mode	Wind High Mode	RASS
First Gate	152 m	152 m	157 m
Last Gate	2296 m	3905 m	1628 m
Spacing	58 m	102 m	105 m
Full Scale Velocity	10.2 m/s	10.2 m/s	409.6 m/s

Comments: It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project while retaining the altitude coverage.

B. Auxiliary Equipment

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is the A/C unit sufficient to maintain temperatures in the range specified in the SOPs?	Yes	Yes
2. Is the site temperature recorded?	No	See below
3. Is the site temperature maintained at 20-30°C?	Yes	See below
4. Is the site kept clean enough to allow operation of all instruments as specified in the SOP?	Yes	Yes
5. Does the modem work?	Yes	Yes
6. Does the telephone work?	Yes	Yes
7. Is the site secure?	Yes (see below)	Yes
8. Overall, is the auxiliary equipment maintenance sufficient to meet the DQOs?	Yes	Yes

Comments: 2. There is no measurement of the shelter temperature. It was indicated that the temperature is not critical for the system operation.

7. Security is good. There are no signs warning of potential audio or radio frequency radiation. Appropriate signage is recommended.

C. Station Check Procedures and Documentation

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Are the station logs present?	Yes	Yes
2. Are the station logs up to date?	Yes	Yes
3. Do station logs contain details as required by the SOPs?	Yes	Yes
4. Are routine checklists used?	Yes	Yes
5. Do the routine checklists contain details as required by the SOPs?	Yes	Yes
6. Are the calibration forms present?	No	See below
7. Do the calibration forms contain details as required by the SOPs?	NA	NA
8. Are the SOPs present?	Yes	Yes
9. Are the instrument manuals present?	No	See below
10. Do the SOPs include quality control tests?	Yes	Yes
11. If quality control tests are included then how are the results of the tests documented?	In site checklist	Yes
12. Has the site technician undergone training as specified in the SOPs?	See Below	Yes
13. Is the site visited twice weekly?	No	See below
14. Does the site technician understand the SOPs?	Yes	Yes (see below)

Comments: 6. Calibration records are maintained at NOAA/ETL

9. Manuals are maintained at NOAA/ETL. If repairs are needed then the engineer brings the manuals to the site.

12. There are no site technicians. During most times there is an engineer in the field that travels from site to site for the checks and needed maintenance.

13, 14. The site is visited approximately every four weeks for routine maintenance. In between the visits the data are polled and reviewed on a regular basis. Data are retrieved hourly and reviewed daily. There is a potential for problems to occur such as propeller failure or RASS source failure that would go unnoticed for up to four weeks. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited prior to the start of the IOP.

D. Chain of Custody

1. Review paper work for chain of custody from field to data processing.	Comments: The site is inspected every four weeks with all data archived at that time. Paperwork older than about two months is forwarded to NOAA/ETL.
2. How are data stored?	Data are stored locally on the computer hard drive with consensus files and surface data transferred on an hourly basis to the communications computer. The files on the communications computer are downloaded to NOAA/ETL on an hourly basis and then erased.
3. How often are the data backed up?	Files are copied to an optical drive on an hourly basis. These data are recovered on a monthly basis when the engineer visits the site.

Comments: 1. It is recommended a carbonless or similar form be used for the site checklist. In that manner a copy could be left at the site while the original can be sent back to NOAA/ETL.

V. Preventive Maintenance

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is preventive maintenance discussed in the SOPs?	Yes	Yes
2. Is preventive maintenance being performed?	Yes	Yes
3. Are field operators given special training in preventive maintenance?	Yes	Yes
4. Are tools and spare parts adequate at the site to meet the requirements of the SOPs?	See below	Yes
5. Are maintenance logs maintained and reviewed?	Yes	Yes

Comments: 4. Tools and spares are carried with the field engineers. Some spares such as RASS transducers are stored at various sites throughout the NOAA/ETL network.

VI. Overall Comments

Question	Response (Yes/No)	Meet Work Plan (Yes/No)
1. Overall, is the station maintenance sufficient to meet the DQOs?	Yes	Yes
2. Does the siting meet the program objectives?	Yes	Yes
3. Overall, is the site technician trained as specified in the SOPs?	Yes	Yes
4. Does the QC program appear to be working?	Yes	Yes
5. Overall, does the meteorological data look reasonable?	Yes	See below
6. Overall, does the data appear to meet the program objectives?	Yes	Yes

Comments: 5. During the period of the audit the vertical extent of the RASS data looked limited. Whether this was due to the current meteorological conditions or the partially covered RASS source dish on the north side is unknown. A review of RASS data collected over the last 4 to 5 days showed a capability to about 800 meters, on the average. It is recommended the RASS be operated at a finer resolution (about 60 m), such as other systems in the project. The current mode of operation is 106 m. The finer resolution will remove some of the spatial averaging and provide a much clearer picture of the atmosphere. When changing the resolution, the height range should be maintained by increasing the number of range gates collected.

SCOS97-NARSTO AUDIT RECORD
VISTA, ORIENTATION AND LEVEL

Site Name:	Van Nuys	Instrument:	NOAA ETL RWP
Date:	July 10, 1997	Receiver s/n:	915-32-8
Time:	1200 PDT	Interface s/n:	915-32-8
Measurements group:	NOAA/ETL	Firmware version:	POP 4.1
Key contact:	Scott Abbott	System antenna angles:	029°, 134°
Audited by:	Alex Barnett	Measured orientation:	028°, 128°
Site longitude:	118° 29.54' W	Orientation difference:	1°, 6°
Site latitude:	34° 12.97' N	Antenna inclination diff.:	NE < 0.2° from 15° SE = 0.5° from 15° < 0.3° on vertical
Site elevation:	241m	Horizontal beam angle:	15°
Magnetic declination:	14° (appx)	Beam directions:	029°, 134° ind.

Mag. Az. Angle (deg)	True Az. Angle (deg)	Terrain El. Angle (deg)	Features and Distances
NA	0	5	Aircraft ramp. Trees at ~ 400m.
NA	30	5	Open to runway. Trees at ~ 400m.
NA	60	10	Open to runway. Trees at ~ 400m.
NA	90	15	Runways, hangars, and trees at ~ 400m.
NA	120	5	Hangers across runways.
NA	150	15	Trees at ~ 30 m.
NA	180	30	Single story building at ~ 30 m.
NA	210	30	Single story building at ~ 30 m.
NA	240	50	Power pole at ~ 30 m.
NA	270	70	Tower at ~30 m.
NA	300	10	Hangers at ~ 250 - 300 m.
NA	330	15	Hangars at ~ 200 m.

Comments: The southeast beam orientation is off by 6°. The orientation setting in the radar was corrected following the audit. The antenna system is three-axis. The RASS system is operating with approximately a 3.5 minute consensus period. A five-minute period is recommended. The RASS has 12 range gates with approximately 100 meter gate spacing. A range up to 1500 meters with a gate spacing of 60 meters is recommended. The RASS source dish on the south side was out of level by 1.7°. The west RASS source dish was out of level by 1.3°. The level was corrected following the audit.

SCOS97-NARSTO AUDIT RECORD
HORIZONTAL WIND SPEED

Date: July 10, 1997
Start: 11:10 PDT
Finish: 11:20 PDT
Auditor: Alex Barnett

Site name: Van Nuys
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Scott Abbott

Sensor Mfg: R.M. Young
Sensor s/n: 21133
K factor: 1.4
Range: 0 - 50 m/s
Logger: Campbell
Logger s/n: XXXXX
Prop s/n: 55971

Model: 5103AQ
Sensor Ht.: 10 meters
Starting torque: gm-cm
Starting Threshold: 0.00 m/s

Last calibration date: XXXX

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

WS Calibration Point	M/S Input	M/S Chart	M/S Diff. Chart	M/S DAS	M/S Diff. DAS	% Diff. DAS
1	0.0	#N/A	#N/A	0.0	0.0	#N/A
2	2.5	#N/A	#N/A	2.4	-0.1	#N/A
3	4.4	#N/A	#N/A	4.4	0.0	#N/A
4						
5						
6						

Pass/Fail Criteria: +/-.25 m/s; ws <= 5 m/s
+/- 5%; ws > 5 m/s

Comments: Torque test not performed.

SCOS97-NARSTO AUDIT RECORD
HORIZONTAL WIND DIRECTION

Date: July 10, 1997
Start: 10:55 PDT
Finish: 11:06 PDT
Auditor: Alex Barnett

Site name: Van Nuys
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Scott Abbott

Sensor Mfg: R.M. Young
Serial No.: 11/09/57
K Factor: 29.8
Range: XXXX
Logger: Campbell
Logger s/n: XXXXX

Model: 5103AQ
Sensor Ht.: 10 meters
Starting torque: gm-cm
Starting threshold: 0.00 M/S

Last calibration date: XXXX

Crossarm: 174 deg true

Cal. Factors

	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

WD Audit Point	Degrees Reference	Corrected Degrees Reference	Degrees Chart	Diff. Chart Deg.	Degrees DAS	Linearity	Total Diff DAS Deg.
Orientation	174.0				183.0		9.0
1	88	88.0	#N/A	#N/A	97.0	0.3	9.0
2	174	174.0	#N/A	#N/A	183.0	0.3	9.0
3	264	264.0	#N/A	#N/A	272.0	-0.8	8.0
4	354	354.0	#N/A	#N/A	363.0	0.3	9.0
5							
6							
7							
8							
9							
10							
11							
Avg difference:							8.8
Maximum difference:						-0.8	9.0

Criteria: Orientation: +/- 2 degrees
Linearity: +/- 3 degrees
Maximum Difference: +/- 5 degrees

Comments: Sensor offset. Corrected after the audit.
Torques test not performed.

SCOS97-NARSTO AUDIT RECORD
AMBIENT TEMPERATURE

Date: July 10, 1997
Start: 11:42
Finish: 11:55
Auditor: Alex Barnett

Site name: Van Nuys
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Scott Abbott

Sensor Mfg: Campbell
Serial No.: XXXX
Range: -50 to 5(Deg C

Model: CS2075713
Sensor Ht.: 2 Meters

Logger: Campbell
Logger s/n: XXXXX

Last calibration date: XXXX

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

Temperature Audit Point	Deg C Input	Deg C Chart	Deg C Diff. Chart	Deg C DAS	Deg C Diff. DAS
1	28.0	#N/A	#N/A	28.1	0.1
2					
3					

Criteria: +/- 0.5 degree Celsius

Comments:

SCOS97-NARSTO AUDIT RECORD
RELATIVE HUMIDITY (DEW POINT TEMPERATURE)

Date: July 10, 1997
Start: 11:42
Finish: 11:55
Auditor: Alex Barnett

Site name: Van Nuys
Project: SCOS97-NARSTO
Operator: NOAA
Site Operator: Scott Abbott

Sensor Mfg: Campbell
Serial No.: XXXX
Range: 0 - 100 Percent

Model: CS
Sensor Ht.: 2 Meters

Logger: Campbell
Logger s/n: XXXXX

Last calibration date: XXXX

Cal. Factors	Chart	DAS
Slope:	1.000	1.000
Int.:	0.000	0.000

RH/DP Audit Point	%RH Input	Deg C Input	% RH Chart	Deg C Chart	Deg C Diff. Chart	%RH DAS	Deg C DAS	Deg C Diff. DAS
1	42.3	14.0	#N/A	#N/A	#N/A	58.0	8.4	-5.6

Criteria: +/- 1.5 degree Celsius

Comments: Did not meet audit criteria.

WARNER SPRINGS (WSP)

SCOS97-NARSTO AUDIT SUMMARY
RADAR PROFILER/RASS/SODAR/SURFACE METEOROLOGY

Site:	Warner Springs (WSP) (reaudit)
Audit Dates:	September 10, 1997
Instrumentation Audited:	Sodar
Key Person(s):	Jeff Bradley
Auditor:	Robert A. Baxter

The purpose of this summary is to provide a report of significant audit findings for the reaudit that was performed on September 10, 1997. The reaudit was performed to help resolve differences in the response of the sodar to known inputs observed in the initial audit performed on August 8, 1997. A summary of the findings of the reaudit is provided below.

The reaudit consisted of the following:

a) repeating the inputs and levels provided during the August 8 audit;

b) reducing the output power of the APT to provide a response that was closer in amplitude to the atmospheric signals;

c) reducing the sodar output power and maintaining the APT lower power in (b) to minimize the mixing of ambient returns with the simulated returns;

d) providing APT inputs into a replacement sodar (electronics system) that was being installed at the site.

The results of the repeated inputs in (a) were the same as the initial audit. The output power of the APT was 50 mv. The observed AGC values were 14 to 18.

By reducing the output power of the APT in (b) to about 3 to 4 mv, AGC values in the 51 to 53 range were obtained. The response results of the sodar to the APT inputs were identical to the results in (a) with some mixing of the atmospheric echoes in the lowest levels.

By reducing the output power of the sodar in (c) the mixing of the lowest echoes was reduced with the results from the sodar response equivalent to those in (a) and (b). As a further test, two different frequencies were selected as the sodar inputs that were closer to center filter frequencies of the sodar. The selection of the new frequencies provided sodar horizontal wind responses within ±0.3 m/s.

Following the swapping of the sodar electronics units (replaced s/n 5 with s/n 15) in (d), the same tests were performed in (c) above. Results of the tests were comparable to s/n 5. However, there was a slight change in the response to the simulated winds in the lower half of the profile.

On the basis of the tests performed during the reaudit, the following conclusions can be drawn:

1. The response of the sodar to known inputs did not change with varying power levels of the APT. This indicates that even if the front end electronics of the sodar were saturated during the audit, it did not alter the response characteristics to known APT inputs. The differences observed were therefore due to some other reason.
2. Decreasing the output power of the sodar to minimize the mixing of atmospheric returns with the simulated signal did not alter the sodar response.
3. There appears to be a change in the response when the simulated signals correspond to frequencies in the middle of the sodar frequency bins versus in-between the centers. Changing the selected frequencies to near the center of the bins appeared to produce results closer to the APT audit inputs.
4. Overall, the differences observed between the APT inputs and sodar outputs varied depending on the frequencies selected. While it is not completely understood what the reasons are for the variations, the sodar does appear to be responding appropriately to the APT inputs. Furthermore, additional examination of the system and the internal calculations showed it was accurately handling the programmed 16° zenith angle. The results of the performance audit therefore show the sodar to responding appropriately.

SCOS97-NARSTO

SITING AND SYSTEM AUDIT FORM

MEASUREMENTS GROUP:	AeroVironment, Inc.
SITE NAME AND LOCATION:	Warner Springs (WSP)
AUDITOR:	Robert A. Baxter
DATE:	August 8, 1997
KEY PERSON:	Jeff Bradley

I. Observables

A. Meteorological

Observable	Method	Manufacturer	Model	Serial #	Range
Wind Speed/ Wind Direction	Sodar	AeroVironment	2000	005	Vert. 0 - 900 m in 30 m inc. Hor. 0 - 999 m in 33 m inc.
Atmospheric Structure	Sodar digital facsimile	AeroVironment	DFS	NA	0 - 900 m
Virtual Temperature	NA	NA	NA	NA	NA
10 m Wind Speed	NA	NA	NA	NA	NA
10 m Wind Direction	NA	NA	NA	NA	NA
2 m ambient temperature	NA	NA	NA	NA	NA
2 m relative humidity	NA	NA	NA	NA	NA
Data Logging	NA	NA	NA	NA	NA

Comments: The reported horizontal wind data assumed a 30° zenith angle. The height range indicated above has corrected the reported data to the programmed 16° zenith angle.

Are there any required variables which are not measured? No

Are there any methods and/or equipment that are not in the SOP? See Below

Do any operating ranges differ from those specified in the SOP? See Below

Are there any significant differences between instrumentation on site and the SOP? See Below

Comments: The SOP for the station operation was not available at the time of the audit.

B. Auxiliary Equipment

Type	Manufacturer	Model	Serial #	Last Calibration Date
Communications computer	NA	NA	NA	NA
Communications software	AeroVironment, Inc.	DopImain v3.4	NA	NA
Facsimile software	AeroVironment, Inc.	DFS 2000	NA	NA

Comments:

B. Station Check Equipment

Type	Manufacturer	Model	Serial #	Comments
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA
NA	NA	NA	NA	NA

Comments: Station check equipment is carried with the AeroVironment engineers and not left on site.

II. Sensor/Probe height and Exposure

A. Radar Profiler/RASS/Sodar

Variable	Value	Meet SOP (Yes/No)
1. Orientation (three axis sodar antenna)	-2°	Yes
2. Level (level and inclination of the antennas)	NS -- 1.4° EW -- 1.2° Vert -- 1°	No
3. Distance to closest obstruction	Not significant	Yes
4. Distance to closest active noise source	Surrounding hay bales have tarps that make noise in the wind.	No

Comments: No SOP was available for review.

2. The level of all antennas was outside of the audit criteria of ±0.5°. The level was corrected following the audit.

4. A listen only test of the sodar revealed no significant audio sources nearby. However, recently installed tarps covering the hay bales do make noise when the wind blows. This noise will degrade the performance of the sodar.

B. Surface Meteorology

Variable	Value	Meet SOP (Yes/No)
1. Height of wind sensors above ground	NA	NA
2. Distance to nearest obstacle	NA	NA
3. Is separation at least 10x obst. height?	NA	NA
4. Are instruments on a rooftop?	NA	NA
5. Is exposure 1.5x height above roof	NA	NA
6. Arc of unrestricted flow	NA	NA
7. Height of temp sensor above ground	NA	NA
8. Distance of temp sensor from obst.	NA	NA
9. Height of DP/RH sensor above ground	NA	NA
10. Distance of DP/RH sensor from obst.	NA	NA
11. Are the distances 4x the obst. height?	NA	NA
12. Is the sensor shielded or aspirated?	NA	NA
13. Are the T/DP/RH abv representative terrain?	NA	NA
14. Are there significant differences between on-site equipment and the monitoring plan?	NA	NA

Comments: No surface meteorological measurements are made at this site. Measurements are made approximately one kilometer to the north at another monitoring site. However, a brief review of that site indicated there may be some siting problems making the data unrepresentative of the surface meteorology.

III. Operation

A. Sodar

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is all instrumentation operational?	Yes	See Below
2. Are all cables secure?	Yes	See Below
3. Are all cables connected according to SOPs or instrument manuals?	Yes	See Below
4. Are connections clean and rust free?	Yes	See Below
5. Are serial numbers available?	Yes	See Below
6. Do data system times agree with audit times. If not, what is the deviation?	Yes	See Below
7. Is the printer functional?	No	Not used
8. Overall, is the site maintenance sufficient to meet the DQOs?	Yes	See Below

Comments: No SOP was available for review.

B. Radar Profiler/RASS/Sodar Settings

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Software version	SI version	See Below
2. Vertical pulse length	~250 ms	See Below
3. Horizontal pulse length	~180 ms	See Below
4. Time zone	PST	See Below
5. Wind data averaging	15 min	See Below

Comments: No SOP was available for review.

	Vertical Wind	Horizontal Wind
First Gate	60 m	67 m
Last Gate	900 m	999 m
Spacing	30 m	33 m

Comments: The printout of data assumed a 30° zenith angle for the horizontal winds. The values above correct this to the actual of 16°.

B. Auxiliary Equipment

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is the A/C unit sufficient to maintain temperatures in the range specified in the SOPs?	Yes	See below
2. Is the site temperature recorded?	Yes (min/max thermometer)	See below
3. Is the site temperature maintained at 20-30°C?	Yes	See below
4. Is the site kept clean enough to allow operation of all instruments as specified in the SOP?	Yes	See below
5. Does the modem work?	Yes	See below
6. Does the telephone work?	Yes	See below
7. Is the site secure?	See below	See below
8. Overall, is the auxiliary equipment maintenance sufficient to meet the DQOs?	Yes	See below

Comments: No SOP was available for review.

7. There is no fence around the sodar antennas allowing the possibility of vandalism. However, the local contractor does visit the site 1 - 2 times per day so if problems occur they would be noted in a timely manner. A locking fence around the antennas should be considered. Additionally, there are no signs warning of potential audio frequency radiation. Appropriate signage is recommended.

C. Station Check Procedures and Documentation

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Are the station logs present?	Yes	See below
2. Are the station logs up to date?	Yes	See below
3. Do station logs contain details as required by the SOPs?	Yes	See below
4. Are routine checklists used?	Yes	See below
5. Do the routine checklists contain details as required by the SOPs?	See below	See below
6. Are the calibration forms present?	No	See below
7. Do the calibration forms contain details as required by the SOPs?	NA	See below
8. Are the SOPs present?	No	See below
9. Are the instrument manuals present?	No	See below
10. Do the SOPs include quality control tests?	See Below	See below
11. If quality control tests are included then how are the results of the tests documented?	In site checklist	See below
12. Has the site technician undergone training as specified in the SOPs?	See below	See below
13. Is the site visited twice weekly?	See below	See below
14. Does the site technician understand the SOPs?	NA	See below

Comments: No SOP was available for review.

5. The checklist was not available at the time of the audit. It will be reviewed when available.

6, 7. Calibration records are maintained at AeroVironment.

8. The SOPs were not at the site. It was indicated they were in final revision and would be sent to the site along with the checklist forms when complete.

9. Manuals are kept with the AeroVironment engineers and not maintained at the sites. If repairs are needed then the engineer has the manuals with him.

10. SOPs will be checked when available.

12. SOPs will be checked when available.

13, 14. The site will be visited by an AeroVironment engineer about every two to four weeks, but with no set schedule. A local contractor does visit the site a couple times a day and visible problems or vandalism is reported immediately to AeroVironment. Data are polled and reviewed daily to identify potential problems. If a key Intensive Operational Period (IOP) is forecast, it is recommended the site be visited by an AeroVironment engineer prior to the start of the IOP.

D. Chain of Custody

1. Review paper work for chain of custody from field to data processing.	Comments: Data (both wind and digital facsimile) are downloaded by modem daily and screened for problems. Screened wind data are then forwarded to SDCAPCD about every three days by e-mail. Log entries are maintained at the site.
2. How are data stored?	Data are stored locally on the communications computer hard drive. The files on the communications computer are compressed and downloaded to AeroVironment on a daily basis.
3. How often are the data backed up?	Copies of all data are downloaded daily to AeroVironment.

Comments: 1. It is recommended a carbonless or similar form be used for the site checklist. In that manner a copy could be left at the site while the original can be sent back to AeroVironment.

V. Preventive Maintenance

Question	Response (Yes/No)	Meet SOP (Yes/No)
1. Is preventive maintenance discussed in the SOPs?	See below	See below
2. Is preventive maintenance being performed?	Yes	See below
3. Are field operators given special training in preventive maintenance?	Yes	See below
4. Are tools and spare parts adequate at the site to meet the requirements of the SOPs?	See below	See below
5. Are maintenance logs maintained and reviewed?	Yes	See below

Comments: No SOP was available for review.

1. No SOP was available for review.
4. Tools and spares are carried with the field engineers.

VI. Overall Comments

Question	Response (Yes/No)	Meet Work Plan (Yes/No)
1. Overall, is the station maintenance sufficient to meet the DQOs?	Yes	Yes
2. Does the siting meet the program objectives?	Yes	Yes
3. Overall, is the site technician trained as specified in the SOPs?	Yes (see below)	See below
4. Does the QC program appear to be working?	Yes	Yes
5. Overall, does the meteorological data look reasonable?	See below	See below
6. Overall, does the data appear to meet the program objectives?	Yes	Yes

Comments: 3. The local contractor is only used to watch over the site and provide support in power and other logistics. He does not get involved in the technical aspects of site operation.

5. The sodar data over a several day period were reviewed. During the nighttime and early morning hours apparent reflections were observed below about 240 meters. These suspect data can be seen on the three days reviewed (8/5, 8/6 and 8/7) by the relatively low component speeds in that altitude range with some periods showing higher speeds above and below the region. A typical example is on 8/5 from 2215 to 2230. The reflections were not apparent during the daytime hours. Data above that region appeared reasonable.

SCOS97-NARSTO AUDIT RECORD
VISTA, ORIENTATION AND LEVEL

Site Name:	Warner Springs	Instrument:	AV 2000
Date:	August 8, 1997	Receiver s/n:	005
Time:	1500 PDT	Interface s/n:	005
Measurements group:	AeroVironment, Inc.	Software version:	SI version
Key contact:	Jeff Bradley	System antenna angles:	25°
Audited by:	Bob Baxter	Measured orientation:	27°
Site longitude:	116° 41' 08" W	Orientation difference:	-2°
Site latitude:	33° 19.08' N	Antenna inclination diff.:	EW trans – 17.2° NS trans – 17.4° Vert trans – 1.0°
Site elevation:	NA	Horizontal beam angle:	16° ind.
Magnetic declination:	14° (appx)	Beam directions:	25°, 115° ind.

Mag. Az. Angle (deg)	True Az. Angle (deg)	Terrain El. Angle (deg)	Features and Distances
NA	0	18	Tree at ~25 m. Wind sock for heliport at ~1 km.
NA	30	18	Tree at ~25 m, hillside at ~500 m. Hill is ~8° elevation.
NA	60	10	Hillside at ~500m.
NA	90	7	Hills at ~700 m. Power lines at ~ 100m.
NA	120	4	Power lines and road at ~150 m.
NA	150	22	Oak tree at ~35 m.
NA	180	22	Oak tree at ~35 m.
NA	210	18	Oak tree at ~45 m. Inst. shelter and trees at ~100 m.
NA	240	20	Oak tree at ~50 m.
NA	270	11	Trees at ~75 m.
NA	300	10	Trees and brush at ~75 m.
NA	330	12	Trees and brush at ~75 m.

Comments: Hay bales were recently placed around the antennas to help suppress echoes from the surrounding trees and hillsides. The level of all sodar transducers were outside the audit criteria of ±0.5° from indicated. This may have been caused by the weight of the hay bales. The levels were corrected following the audit. The orientation was checked using the solar siting corrected magnetic orientation of the antenna trailer. The siting was performed within the hay bales and within 2 meters of the trailer tongue. Two measurements were made to verify the orientation, one on the north rail and one on the south rail.

SCOS97-NARSTO AUDIT RECORD
APT -- DOPPLER SODAR

Date: 08/08/97
Start: 1130 PDT
Finish: 1230 PDT
Auditor: Bob Baxter

Site name: Warner Springs
Project: SCOS97-NARSTO
Operator: AeroVironment
Site Operator: AeroVironment

Sensor Mfg: AeroVironment
Serial No.: 005
Sodar software ver.: SI version
Range: 60 - 900 m Vert., 66 - 999 m Horiz.
Avg. Int.: 15 minute
System rotation angle: 25° ind.
Transp. mode: Continuous tone, two frequency wind shear
APT software ver.: 1.06

Model: 2000
Frequency: 1497 Hz
Measured Antenna Rotation (deg): 27
Zenith angle: 16°
Mag. Declination: NA
Last cal. date: NA
APT File: 08081123.APT
Antenna level: NS -- +1.2°
EW -- +1.4°
Vert -- +1.0°

Time (PDT)	Level	Horizontal: APT Input NS (m/s)	APT Input EW (m/s)	Sodar Output NS (m/s)	Sodar Output EW (m/s)	Comp Diff. NS (m/s)	Comp Diff. EW (m/s)	APT Res In Speed (m/s)	APT Res In Dir (deg)	Sodar Res Out Speed (m/s)	Sodar Res Out Dir (deg)	Result. Diff. Speed (m/s)	Result. Diff. Dir (deg)	Vertical: Audit Input (m/s)	Vertical: Sodar Output (m/s)	Vertical: Diff (m/s)
1130	1	4.78	4.78	4.04	4.10	-0.74	-0.68	6.76	72	5.76	70	-1.00	-2	-1.32	-1.38	-0.06
to 1145	2	-8.32	-8.32	-7.91	-7.92	0.41	0.40	11.77	252	11.18	250	-0.59	-2	2.29	2.34	0.05
1145	1	4.78	4.78	4.09	4.08	-0.69	-0.70	6.76	72	5.77	70	-0.99	-2	-1.32	-1.38	-0.06
to 1200	2	-8.32	-8.32	-7.91	-7.92	0.41	0.40	11.77	252	11.19	250	-0.58	-2	2.29	2.34	0.05
1200	1	4.78	4.78	4.09	4.08	-0.69	-0.70	6.76	72	5.77	70	-0.99	-2	-1.32	-1.38	-0.06
to 1245	2	-8.32	-8.32	-7.91	-7.91	0.41	0.41	11.77	252	11.18	250	-0.59	-2	2.29	2.34	0.05
		Average Difference (level 1)				-0.71	-0.69					-0.99	-2			-0.06
		Average Difference (level 2)				0.41	0.40					-0.58	-2			0.05
		Maximum Difference (level 1)				-0.74	-0.70					-1.00	-2			-0.06
		Maximum Difference (level 2)				0.41	0.40					-0.59	-2			0.05

Audit Criteria (component): ±0.2 m/s
Audit Criteria (resultant): ±0.5 m/s, ±5°
Audit Criteria (altitude transition): ±1 range gate (30 - 33 m)

APT transponding information

Transponding pulse length (ms): Cont.
Transponder delay from pulse detection (ms): 0
Number of reporting altitudes: 2
Anticipated horiz. reporting alt. for transition level 1 (m): 327
Anticipated horiz. reporting alt. for transition level 2 (m): 686
Anticipated vert. reporting alt. for transition level 1 (m): 340
Anticipated vert. reporting alt. for transition level 2 (m): 714
Sodar transmit frequency (Hz): 1497
Assumed speed of sound (m/s): 340

APT Frequency Delay (ms)	APT Transponding Frequency (Hz)	Analysis Levels (m) Horiz.	Analysis Levels (m) Vert.	Measured Trans. (m) Horiz.	Measured Trans. (m) Vert.
2000	U, V, W = 1508.6	133-300	90-300	300	300
4200	U, V, W = 1476.8	466-699	450-720	700	720

Comments

The sodar was operated in the non-vertical velocity (w speed) correcting mode. Corrections for vertical velocity should be performed in the post processing of the data.
The response used six frequencies to gradually transition through the simulated wind shear. This transition occurred over a period of 300 ms.
The reported resultant data accounts for the measured offset in the antenna alignment.
The altitude transition was within criteria
The vertical wind speed response was within criteria
The horizontal wind speed response was outside criteria. While the response was very consistent, the sodar manufacturer has indicated the audit method may have saturated the sodar input. This may cause unpredictable results. The sodar response to strong signals is being explored.